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Civil Engineering.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notes on the Internal Improvements of the Continent of Europe.
By L. KLEIN, *Civil Engineer.*

[CONTINUED FROM PAGE 79.]

IV.—*Emperor Ferdinand's Northern Railroad.*

The fourth railroad undertaken in Austria is the most extensive in Europe, as it will, when completed with all its branches, have a length of nearly 400 miles; I shall therefore be excused for giving a somewhat more detailed account of it. The main line commences at Vienna, the capital and residence of the Austrian Empire, and terminates at Bochnia in Galicia; from this line branches go to Stockerau, Brunn, Olmutz, Troppau, Dwory and Wielitchka; a branch is also to lead to Presbury in Hungary.

Though projected as early as 1830, it was not until the 4th of March, 1836, that the imperial privilege for this gigantic undertaking was granted to Baron Rothschild, in Vienna, authorizing the formation of a company with a capital of seven millions of dollars. The latter was immediately subscribed, and on the 7th of April, 1837, the works were commenced. In November of the same year, the first trips were made to Wagram, a distance of seven miles, and on the 7th of July, 1839, the line from Vienna to Brunn (the capital of Moravia) was put into operation. With the forty-nine miles opened in the present year, there are now 140 miles in operation, and forty miles more will be comple-

ted in the course of two months. Other fifty-three miles are in progress of construction, and as many miles located, which will be commenced as soon as the necessary funds are procured.

Amongst the principal objects of the northern railroad is the transportation of oxen from the interior of Galicia to the Residence; it has been estimated, that not less than 90,000 are coming annually in this direction. By connecting several important cities with Vienna, this railroad will also command a great travel and a considerable traffic in produce and merchandize; it will in every case contribute largely to develope the resources of those provinces through which it passes, and will become still more important by its connexion with the Warsaw and Vienna, the Bochnia and Lemberg, and the Upper Silesian railroads, of which the first and the third are already in progress.

The following sections of the Emperor Ferdinand's northern railroad are either completed, or in progress of construction:

1.	From Vienna to Lundenburg, main line, (opened)	48 miles
2.	From Lundenburg to Brunn, branch, (opened)	43
3.	From Lundenburg to Hradish, main line, (opened)	35
4.	From near Vienna to Stockerau, branch, (opened)	14
5.	From Hradish to Prerau, main line, (nearly completed)	26
6.	From Prerau to Olmutz, branch, do.	14
	Total length completed or nearly so,	180 miles
7.	From Prerau to Ostrau, main line, (in progress)	53
8.	From Ostrau to Oswiecin, where the Warsaw and Vienna railroad terminates, main line, (located, but not commenced)	49

Notwithstanding the great extent of this railroad, it meets no where with extraordinary difficulties; in passing the different summits, which divide the waters of important rivers, it requires neither tunnels nor inclined planes. The curves have no radius shorter than 1500 feet, and the steepest grade is 17.6 feet per mile, or 1 in 300. This grade has been adopted as a maximum for the whole line, it being regarded here, as in England, a very steep grade.

With the exception of only nineteen miles from Vienna, to where the branch road to Presburg is to leave the main line, the road has only a single track of the ordinary width of 4 feet 8½ inches. The width of the road bed is 12½ feet, and the slopes are = 1½ to 1. On the line from Vienna to Brunn of ninety-one miles, now two years in operation, the following works have been executed. Excavations and embankments, 6,012,500 cubic yards; 3708 feet of wooden bridges, the most remarkable of which are those over the Danube at Vienna of 1960 feet in length, with spans of 60 feet; 488 feet of wooden

bridges with stone piers; 24 stone bridges and viaducts with 228 arches of different spans; 116 culverts; 198 road crossings, of which 31 are under, 6 over, and the remainder level with, the railway.

The superstructure consists of the iron T rail of 40 lbs. per yard, resting in chairs fastened upon cross ties of oak, larch, or fir, 7½ feet in length and 12 inches in diameter, half round, and placed 3½ feet apart upon a bed of gravel, 12 inches thick. The chairs at the joints weigh 15 lbs., the others 12 lbs., and the rails are fastened into them by two iron keys driven in from both sides of the chair outside the track. The rails were partly imported from England, partly manufactured in Austria, and the cost per ton (2240 lbs.) was in both cases from 130 to 135 dollars! owing to the high duty on imported iron, and to the inexperience in the manufacture of rails at home. The price of the chairs was 44 dollars per ton, delivered to the road.

The system adopted here in letting the works is different from that generally followed in America, and deserves to be noticed. The line for a section of the railroad being definitely fixed and located, the profiles, showing the excavations and embankments, and the plans of all the works of art, as: bridges, viaducts, road-crossings, culverts, &c., are executed with the necessary detail, and then the estimates, founded upon the prices of materials and labour in the district through which the line passes, and which are ascertained with the utmost precision, are prepared accordingly. Contractors, of whom there are seldom more than two or three parties, then inspect the plans and estimates, and in their written proposals declare *for how much per cent. below the estimated amount* they offer to execute the works. Generally, the latter are let at from eight to twelve per cent. below the Engineers' estimates, and the contractors are nevertheless realizing a good profit. They let the works again in smaller sections to sub-contractors, who employ many female labourers, who work for low wages. The superstructure is not let to contractors, the object of the company being to insure a more solid and durable work.

Besides the principal depots at the termini of the main line and branch roads, and the smaller ones at the intermediate stopping places, there are along the line small houses for the men who watch and repair the road, at intervals of from 1 to 1¼ mile; 80 such houses are between Vienna and Brunn.

The company own at present thirty locomotive engines, of which one was built in Vienna, twenty-four were imported from England, and five from America. Of the latter, the "Baltimore," manufactured by Messrs. Baldwin, Vail & Hufty, in Philadelphia, has been upon the road but a short time, and promises to surpass all others in her performances, as she does by her workmanship and the beautiful ar-

rangement of her parts. The other means of transportation consist in about 180 passenger cars of three different classes, and 200 freight cars. All the cars are four wheeled, and have wheels with wrought iron tires.

According to the last report of the Directors, the following sums had been expended up to the 31st of October, 1840:

For the principal station at Vienna,	197,862 Dollars.
" the section No. 1, from Vienna to Lundenburg,	1,450,832
" the section No. 2, " Lundenburg to Brunn,	1,262,877
" the other sections from Lundenburg towards Olmutz,	1,548,977
" a second track from Vienna to Gaenserndorf, and for other preparatory works towards the construction of the branch road to Presburg,	346,671
" the branch road to Stockerau,	77,547
Inventory account—outfit,	456,252
Interest account,	84,785
Surveys for the Railroad to Prague,	3,178
Total,	5,428,981 Dollars.

Up to the present period, the total amount expended by the company of the Northern Railroad, will exceed six millions of dollars.

Amongst the above sums is the interest paid to the Stockholders at the rate of $4.00 per annum on their instalments. It is a general custom on the continent, that Stockholders receive interest on the sums paid in by them, from the day of the first instalment until the road is put into operation. It is an expedient to induce those capitalists to subscribe, who would be unwilling to invest their money, if they had to wait several years, before getting any interest or profit. It needs not be mentioned, that the proceeding is entirely illusory, as the interest must be paid from the Stockholders' own money.

If we deduct this interest, we find the cost of the railway from Vienna to Brunn with the depot at Vienna, 2,713,586 dollars, and as the length is ninety-one miles, the cost per mile of railroad with a single track, exclusive of outfit was 29,800 dollars; with outfit 33,000 dollars.

From the first of November, 1838, to the 31st of October, 1839, in which period the railroad has been entirely opened only during four months, the total number of passengers conveyed was 263,886, the income 125,080 dollars.

In the year ending 31st of October, 1840, there have been transported over the road between Vienna and Brunn:

228,368 passengers, who paid	201,561 Dollars.
32,160 tons of goods	90,063
Income from other sources,	2,548
Total gross income,	294,172 Dollars;

or, 3,233 dollars per mile, equal to 10 per cent. on the capital of construction.

The expenses of working the railroad have been during the same period, 225,547 dollars, or 2,478½ dollars per mile, leaving only 68,625 dollars as net profit, which is 2¼ per cent. on the capital of construction. The number of miles traveled by all the engines was—188,100; the expenses per mile of travel amounted therefore to 1 dollar 25 cents. The principal cause of the comparatively large expenditure is to be found in the great cost of the fuel, for which coke and coal brought from great distances have hitherto been employed; the expenses for fuel alone amounted in 1840 to not less than 98,533 dollars, or to 52.4 cents per mile of travel.

Up to the first of April, 1841, the passenger fare has been per mile in the first class cars 3.16 cents, in the second class 2.01 cents, and in the third class 1.58 cents. The average receipt per passenger per mile in 1840, was 1.77 cents; the average income or charge per ton per mile 5.1 cents. Since April 1841, the passenger fare has been increased to 4.25 cents in the first, 2.65 cents in the second, and 1.77 cents in the third class cars.

In the course of this summer, several trials have been made with heavy transports of oxen from Hradish to Vienna, a distance of 83 miles. From 100 to 180 oxen were carried in a train, each car containing six to eight. The cars are open on top, and only provided with barriers on the four sides; the oxen stand sideways, and are tied on the car with ropes. As the trip is made in seven or eight hours, they receive no food on the road. A commission, specially appointed for this purpose, inspected the cattle when they arrived at Vienna, and declared, that the conveyance upon the railroad is in no way injurious. The butchers also were perfectly satisfied with the result, and are contented to receive their supply in this new manner.

[TO BE CONTINUED.]

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of the new Track now being laid upon the Baltimore and Ohio Railroad, from Harper's Ferry in Virginia, to Cumberland in Maryland, a distance of 96 miles.

Communicated by BENJAMIN H. LATROBE, Civil Engineer.

The rail is of rolled iron, imported from England; it is of the bridge,

trough, or inverted U section,* 3⅛ inches in height, 4⅝ inches in width at the base, and 2⅝ inches from out to out of the sides of the upright stems; the bars are in lengths of 20 feet, with their ends cut square, and weigh 340 pounds each, or 51 lbs. per lineal yard.

The rolled iron rail, is supported throughout its length, by a *continuous bearing* of sawed timber, 4½ by 8 inches in section, and in lengths of 20 feet, like the *rail-bars* and *sub-sills.*

The *continuous bearing,* reposes flatwise upon *cross-ties* and *bearing blocks,* the *cross-ties* being 4½ by 6 inches in section, laid flatwise upon the *sub-sills,* and notched on the top 1½ inch deep and 8 inches wide, to receive the *continuous bearing;* this notch being cut ⅝ths of an inch deeper on the side next the centre of the track, so that the *continuous bearings* when laid on both sides, mutually decline towards each other at the rate of ⅝ths of an inch in 8 inches, or 1 in 13, thus bringing the top of the iron rail also, into a plane of this inclination, which is the same as that of the cones of the wheels now used upon the Baltimore and Ohio Railroad.

The *bearing blocks* are 3 by 6 inches in section, and 1 foot in length, they are laid crosswise to the track upon their flat sides, and support the *continuous bearing* at points intermediate to the ties, without any notching.

The *cross-ties,* are laid 5 feet apart between their centres, as are the *bearing blocks,* and hence, the *continuous bearing* is supported at points 2½ feet asunder, if we measure from centre to centre of the supports, or has unsupported spaces, of but 2 feet lineal in the clear between their sides.

The *cross-ties* and *bearing blocks,* rest upon *sub-sills,* 3 by 10 inches in section, and also in lengths of 20 feet; at every point of support, the *continuous bearings,* the *cross-ties* or *bearing blocks,* and the *sub-sills,* are pinned together by *tree-nails* 1¼ inch in diameter, and going quite through the three timbers; but where the joinings of the *continuous bearing* occur above a *tie,* two *tree-nails* of an inch in diameter (one in each of the meeting ends of the *continuous bearing*) are used.

The joinings of the *rail-bars* upon the opposite sides of the track, break joint with each other midway of their lengths; they also break joint at the same time with the *continuous bearings* upon which they rest, and these in like manner break joint with the *sub-sills;* every

* This pattern of rail, which in section very much resembles the letter U inverted, and hence, in technical phraseology, ought perhaps to be called the U rail; was invented by S. V. Merrick, Esq., of Philadelphia, in 1831, and by him denominated the *Trough rail,* from its resemblance when inverted, to a trough. (See the number of this Journal for August, 1835.) It has been used upon the Wilmington and Susquehanna Railroad, in this country, and the Great Western Railway in England, and continues to give very satisfactory results.—Ed.

joint of two adjacent timbers of the *continuous bearings*, is made to fall upon a *cross-tie*, and all the joinings in the track are merely square butt joints, no scarfs being used; by this system of distributing the weak and strong points, the strength of the track is equalized.

A cast iron *joint chair*, weighing 7¼ lbs. is placed under the ends of every two adjacent *rail-bars*, and a *centre chair*, also of cast iron, weighing 4 lbs. under the middle of each rail.

The *joint chairs*, together with the *rail-bars*, are fastened down on the *continuous bearing* by two vertical *screw-bolts*, (one on each side of the chair) going through oblong mortise holes made in the timber, and also, through similar apertures in cast iron *bearing-plates*, fastened up against the bottom of the *continuous bearing*, in the interval between two supports, but close to one: the *screw-bolt* is formed with an oblong square head, fitting the mortise hole in one direction only, so that by making a half turn with it after its head has descended below the *bearing plate* just mentioned, it laps over the sides of the oblong hole in that plate, and falling into a recess cast for the purpose, when drawn up by the nut, the *bearing plate* is thus made to grasp the *continuous bearing* firmly; whilst the nut being screwed down upon a wrought iron washer and zinc plate, (designed to protect the iron by galvanic action) which lap upon the projecting base, or feet of the contiguous bars of the U rail, they are thus secured to the joint chair, and the latter to the *continuous bearing*.

The *centre chair*, and the middles of the *rail-bars*, are held down on the *continuous bearing* by four *brad headed spikes*, (each 4½ inches long and $\frac{7}{16}$ square in the shank;) and the iron rail between the *joint* and *centre chairs* is held by twelve similar spikes driven in pairs, (one on each side) at intervals of 2½ feet.

The *chairs* are let their own thickness ($\frac{3}{8}$th of an inch) into the *continuous bearing*, so that their tops are flush with the upper surface of the latter, and the bottom of the rail bears fairly upon both.

The *chairs* have each a projection going up vertically into the hollow of the rail, and two horizontal semi-circular projections on their ends to fit into half round mortises in the wood, to prevent lateral motion.

The *centre chairs*, moreover, have two square projections on the upper surface, which fit notches of the same dimensions ($\frac{3}{8}$ths of an inch square) in the feet of the rail, to confine the bars from longitudinal movement.*

The whole of the track is laid upon, and partly imbedded into, a

* The *seat* of the rail in the chairs, is elevated about $\frac{1}{8}$th of an inch above the rest, and the castings being made as soft as possible, this admits of a portion of the seat being tooled away, whenever necessary, to enable a compensation to be made for small irregularities in the heights of contiguous rails.

ballasting of broken stone, composing a mass of open material—entirely pervious to water—10 feet wide at bottom, 8 feet at top, and 1 foot in depth: the lower part consisting of stone broken to pass every way through a 2 inch ring, and the upper part of such as will in like manner pass a 4 inch ring: the base of the ***ballasting*** is about 4½ inches below the bottom of the ***sub-sill***, and its top, level with the upper surfaces of the ***cross-ties***, or 3 inches below the top of the ***continuous bearing***. The distance between the iron rails, or the ***gauge of the railway***, is 4 feet 8½ inches.

References to the Plate.

A General plan of the superstructure.
B Side view do.
C Transverse section do.
D Side view at the joint of the rail, showing the rail and its fastenings to the continuous bearing.
E Cross section through the continuous bearing at the joint of a rail.
F Plan of the joint chair.
G End view of do.
H Plan of the centre chair.
I End view of do.
J Plan of the bearing plate.
K Plan of the screw bolt.
L Cross section through the rib of the bearing plate.
M Plan of the nut and washer.

Scale of A, B, and C, ¼th of an inch to the foot, the remainder, being the ***details***, are drawn quarter-size.

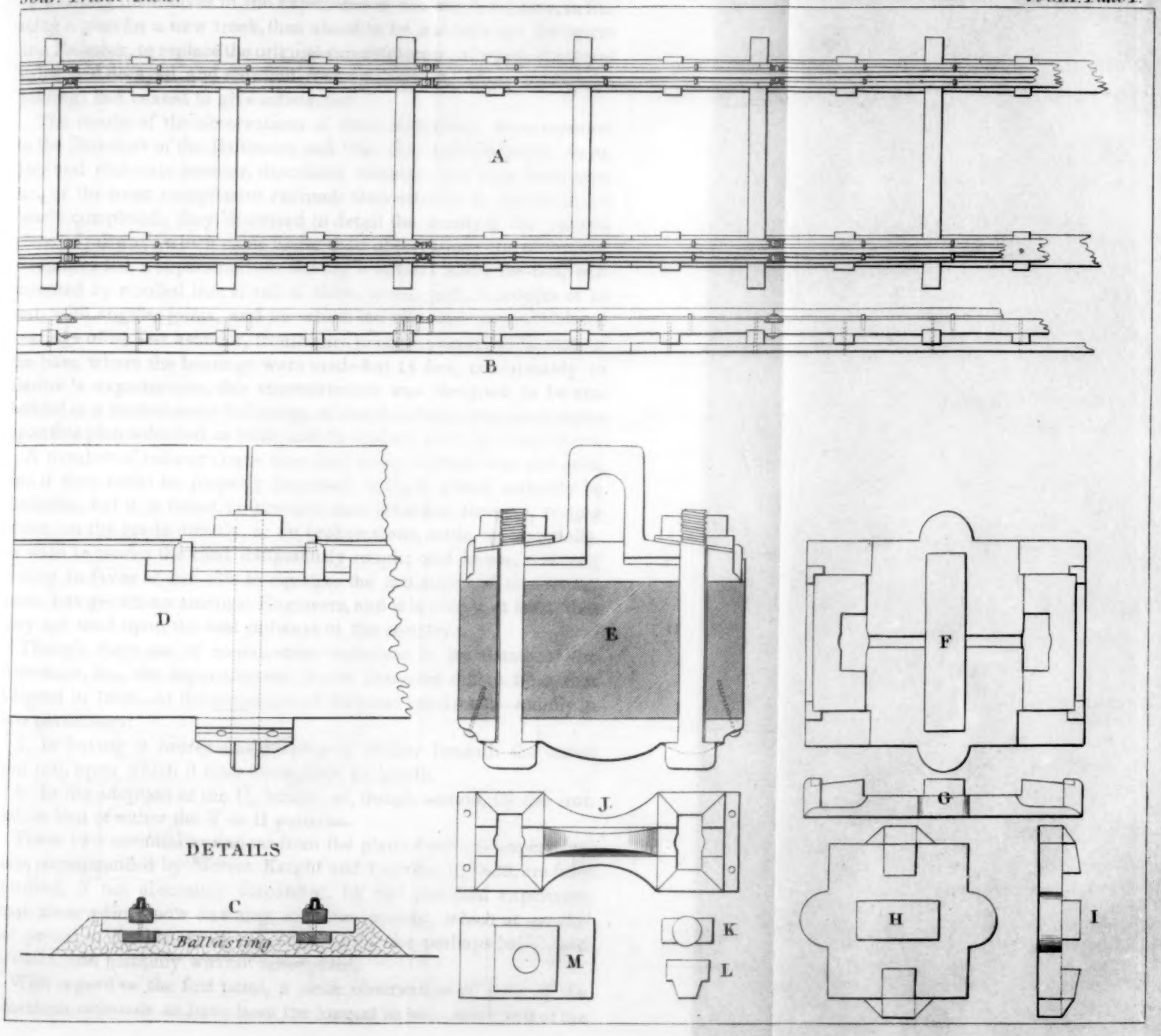
Baltimore, Md., Feb. 1, 1842.

Remarks upon the above. By ELLWOOD MORRIS, C. E., ***one of the Collaborators for the Department of Civil Engineering.***

We invite attention to the foregoing plan of Railway superstructure, as embodying in a great measure, the experience acquired by the railway practice of the country.*

In 1838, Messrs. Knight and Latrobe, the distinguished Engineers of the Baltimore and Ohio Railroad, were specially commissioned to visit the most important railways in the United States, with the view

* From an inspection of the railways of general trade, which have been the longest in use, the writer is strongly disposed to conclude, that it will eventually be found advisable in such railroads as carry a very heavy traffic, and the earthworks of which have acquired the requisite stability, to lay the superstructures in *a bed of concrete*, as has been suggested in the London Mechanic's Magazine; the expense of which, in such cases, would probably be compensated by the additional smoothness of surface, and freedom from derangement, which such a foundation might fairly be expected to impart to railways.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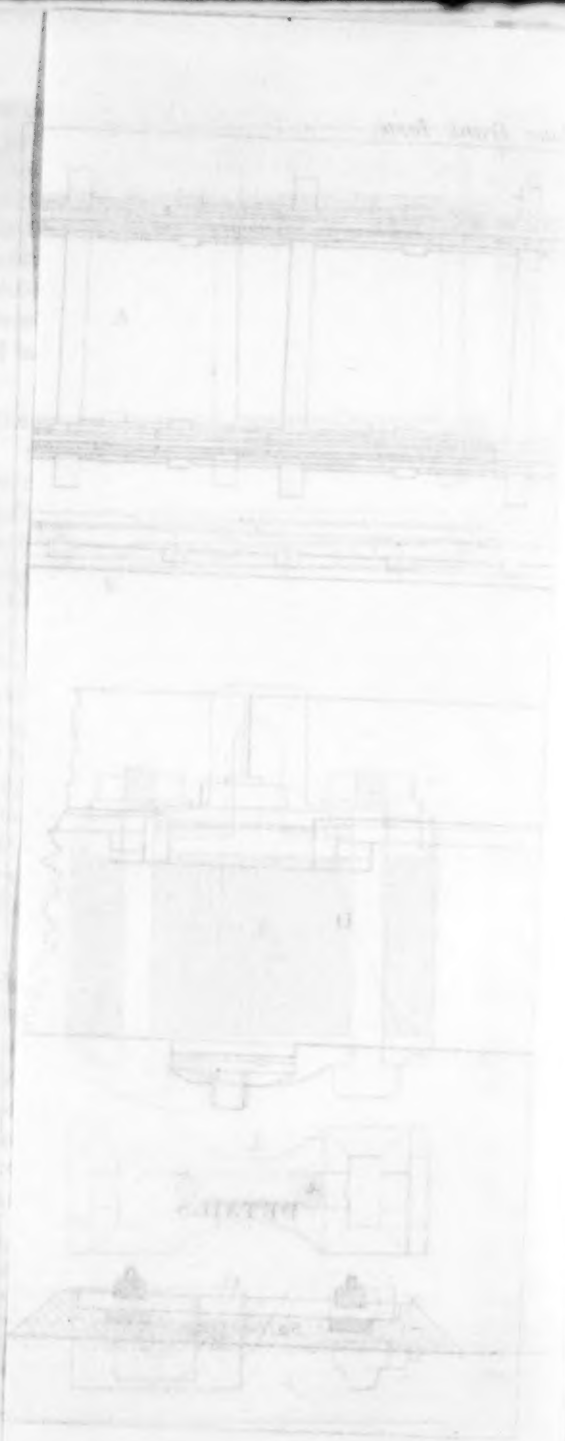

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of availing themselves of the experience of the whole country, in framing a plan for a new track, then about to be laid between Baltimore and Federick, to replace the original superstructure, of which the wood work had decayed and required renewal, and *the stone* continuous bearings had ceased to give satisfaction.

The results of the observations of these Engineers, were reported to the Directors of the Baltimore and Ohio Railroad Company, in an able and elaborate memoir, describing minutely the rails, fastenings, &c., of the most conspicuous railroads then actually in operation, or nearly completed; they discussed in detail the merits of the various plans of railway, which came under their observation; and ultimately recommended a superstructure having a sub-sill and cross-ties, surmounted by a rolled iron H rail of 50 lbs. to the yard, in lengths of 18 feet, with angular joints, and for which the cross-ties formed isolated bearings of 2½ feet asunder, from centre to centre, except at the ends of the bars, where the bearings were made but 1½ feet, conformably to Barlow's experiments; this superstructure was designed to be embedded in a broken stone ballasting, of one foot deep; and many miles upon this plan were laid in 1839, and have since been in constant use.

A number of railways have been laid down without any *sub-sills*, and if they could be properly dispensed with, it would certainly be desirable; but it is found in practice that detached sleepers, resting either on the grade directly, or on broken stone, settle so unequally, as soon to render the road dangerously rough; and hence, a strong feeling in favor of sub-sills to equalize the settlement of superstructures, has grown up amongst Engineers, and it is certain at least, that they are used upon the best railways in the country.

Though there are, of course, some variations in the details of the fastenings, &c., the superstructure above described differs from that adopted in 1838—at the suggestion of the same gentlemen—mainly in two particulars:

1. In having *a continuous bearing of timber* beneath the rolled iron rail, upon which it rests throughout its length.

2. In the adoption of the U, bridge, or trough section, for the iron rail, in lieu of either the T or H patterns.

These two essential variations from the plan of railway superstructure, recommended by Messrs. Knight and Latrobe, in 1838, are fully justified, if not absolutely demanded, by the practical experience upon these points, now dawning upon the country; which at an earlier period in the history of railways, could not perhaps have been foreseen, and certainly was not anticipated.

With regard to the first point, a close observation of such of the American railroads as have been the longest in use—possessed of the

largest trade—and traveled by the heavy locomotive steam engines, which are now so common, will fully satisfy any professional man, that the alternate succession of *"rigid points and flexible spaces,"* which inevitably results from the employment of *isolated bearings*, tends to a more rapid destruction, both of the locomotive machinery and of the road itself, than is likely to ensue, where the iron edge rails are sustained upon *continuous bearings of timber* of heavy proportions; which plan has also the recommendation of having already been practically tested upon the Baltimore and Port Deposite, and Washington branch railroads in this country, and the Great Western, and London and Croydon railways in England—with satisfactory results in each of these cases, so far as the writer is informed—besides being employed upon some other important railways in America, which are now in the course of construction.

Concerning the second point, or the sectional form of the rail—we will observe that the top table of the bars, upon which the wheels run, in the T and H forms—being supported in the centre alone by a single upright stem, in thickness, about one fourth only of the width of the head—soon crushes off on one side or the other of the centre, and renders it necessary to reverse the position of the bars.

On the Baltimore and Ohio Railroad, as the writer is informed, *already* has occasion been found to reverse the position of a number of the bars (of the track laid with the 50 lbs. H rails in 1839) *whose inner flanges have partially peeled off!* and upon the Columbia Railroad, which has been *but seven years in use*, rolled iron rails of the T and H forms may be seen in every stage of destruction;* and though a portion of the disintegration which may there be witnessed, is undoubtedly owing to the intrinsic structure of rolled iron, and hence can only be postponed, and not annihilated, by any change of form or

* Time was, when Engineers generally, were under the impression that rolled iron edge rails of 50 lbs. to the yard, would last from forty to sixty years, but experience is fast dissipating all such ideas, by demonstrating that the duration of rails of malleable iron is not determined by mere superficial wear, but, *by the time which it requires for a given trade rolling upon them, to disrupt the bars into their elementary laminæ;* and the present indications of experience are, that upon railways possessing an amount of trade, equal to that which annually traverses the railroad between Philadelphia and Columbia, rolled iron edge rails of the T and H forms and of ordinary dimensions, will not endure more than ten years.

That the public authorities of our state are becoming aware of the probability of this, may be inferred from the following extract taken from the late report on the condition of the Columbia railroad, made to the Canal Commissioners of Pennsylvania, by W. B. Hufnagle, Esq., the Engineer in charge of that work during the past year.

"One fact, (says Mr. Hufnagle) however, cannot be concealed, that the iron rail which forms the heaviest item in the construction of a railway, exhibits strong symptoms of coming destruction, and even now, a portion should be replaced with new iron of an improved pattern;—the laminæ of which it is composed appear to have become detached, and exfoliate

pattern; still it must be admitted, that if the top table of the rail had been so supported as to prevent it from being forcibly disrupted from its vertical stem, and thus render it subject alone to the natural exfoliations, which occur when malleable iron is exposed to a series of great rolling weights, the durability of that railway would have been essentially increased.

The sort of support to the head of the rail, which practice now shows to be necessary, is given by the double stems of the U section, and not by the single one of the T figure; consequently, it seems to the writer that, experience on existing works, demands in future ones the adoption of the former pattern, in outline at least; for it is a question which time alone can determine, whether we shall not finally come to a solid bar rail as the best; for the present, however, it will probably be the proper course to use the U rail as now rolled hollow, in which form, as it can be made as light as the T and H patterns, its superior durability will gradually cause rails of the latter figure to pass from use, and give place to those of the former pattern, unless a superior section should meanwhile be introduced.

To support these views, it would be easy to cite further examples of the decay of rails of the T and H forms; but it seems scarcely to be necessary, and upon the whole, we are disposed to conclude that the experience of the country, up to this time, indicates the propriety of adopting in future railway superstructures, *a continuous bearing of timber laid with a U rail, upon a suitable substructure*, in preference to any of the other plans now in use, most, if not all of which, seem on trial to possess fewer practical advantages.

In fine, the new superstructure of the Baltimore and Ohio Railroad, appears to combine in its plan, a sufficient provision to satisfy the most important requisites, in favor of which, the railway practice of the country has pronounced—viz:

1. That to guard against disturbance by frost or rainy weather, the superstructure ought to be embedded in a *ballasting*, entirely pervious to water, and of a sufficient depth.

2. That to prevent the track from spreading laterally, numerous *cross-ties* should be employed.

3. That to prevent unequal settlement of the *cross-ties* (which also

under the pressure of the cars, thereby requiring the rail to be reversed, or rendered useless,—this reversion has so frequently taken place that prudence would dictate the importation of at least 50 tons to supply the defective parts."

Here is a striking verification of the prediction made many years ago concerning rails of malleable iron, by W. Chapman, of Newcastle, a distinguished English Engineer, (see Wood on railroads) whose opinions were then strenuously combated by other Engineers, who must now, or soon, admit, that Mr. Chapman's anticipations *were truly prophetic.*

form detached supports for the rails or continuous bearings) *sub-sills* of wood are indispensable.

4. That to render the road more smooth, more equal in strength throughout, capable of carrying greater weights than roads of isolated bearing, and exempt from "rigid points and flexible spaces," *continuous bearings of timber* ought to be employed to carry the iron rail.

5. That the iron rail itself ought to be of the U pattern, (either hollow or solid) as superior in durability to any other known form of section, now in actual use, whilst it is very stable in position, and cheap in its fastenings when properly laid.

6. That the iron rail-bars ought to be firmly fixed at their middle parts, to cause expansion and contraction to take place, both ways from their centres.

These are the principal points to be attended to, though there are others of importance in arranging the details, which will so readily occur to persons conversant with these matters, as not to require any particular reference.

The propriety of augmenting, by any economical means, the durability of the timber of railways, is evidently of the last importance; and it appears to the writer that the process of impregnating wood with the pyrolignite of iron, by means of the aspiration of the sap of newly felled trees,—as prescribed by M. Boucherie,—furnishes a cheap practical mode of rendering timber almost indestructible; and to this process, we would solicit the attention of Engineers, and others connected with railways, in the most pointed manner.

The admirable preservative process of M. Boucherie, has recently been ordered by the Minister of the Marine, (after numerous experiments) to be applied upon a great scale to the preparation of timber for the use of the navy of France; and the "modus operandi" translated from the French periodicals, by Professor J. F. Frazer, may be found detailed at length in this Journal for 1841, to which we refer for more minute information upon this point, as well as for the record of a curious series of experiments on the protection from putrefaction, which is afforded to vegetable substances of the most destructible character, by mixture with solutions of corrosive sublimate, pyrolignite of iron, &c.

To render the description of the new track of the Baltimore and Ohio Railroad still more complete, we have below taken the quantities of the several component materials, (as furnished to us by Mr. Latrobe) and applied to them the scale of prices assumed by that gentleman, in his pamphlet upon the Z rail (as an average for the United States) in comparing the expense of sixteen different tracks of rail-

way, used or projected; (see p. 179 of this Journal for March, 1841) so that in this manner the relative cost of the plan under consideration, may be ascertained, and compared with the rest.

Estimate of the cost of one mile of single track railway, upon the plan now being constructed upon the Baltimore and Ohio Railroad, between Harper's Ferry and Cumberland, (96 miles) using the actual quantities of all materials, and the scale of prices, by which the cost of the same extent of the other railway superstructures, quoted on the next page, has been in each case calculated.

Ballasting.

950	Perches of broken stone to pass through a two inch ring.	
950	Perches of ditto, to pass through a four inch ring,	
1,900	Perches of *ballasting*, at 87½ cents,	$ 1,662 50

Lumber.

					Ft. B. M.
10,560	ft. lineal of	3 ×	10	*sub-sills* in lengths of 20 ft.	26,400
10,560	do	4½ ×	8	*continuous bearings* do.	31,680
7,392	do	4½ ×	6	*cross-ties* in lengths of 7 ft.	16,632
2,112	do	3 ×	6	*bearing blocks* " of 1 ft.	3,168
					77,880
77,880	Ft. B. M. of *Lumber*, at $25 per M.				1,947 00

Tree-nails.

3,696	*Tree-nails*, for *ties and blocks*, 12 in. long, 1¼ in. diam.	
1,056	*Tree-nails*, for *joints of bearings* 12 in. long, 1 in. diam.	
4,752	*Tree-nails* at 1 cent each, average	47 52

Rails of Rolled Iron.

80	tons, in lengths of 20 feet, at $70 per ton,	5,600 00

Fastenings of the Rails.

528	*Cast iron joint chairs*,	each weighing 7¾ lbs.	4,092 lbs.	
528	do *centre chairs*,	do 4 lbs.	2,112 "	
528	do *bearing plates*,	do 2¾ lbs.	1,452 "	
			7,656	
7,656	lbs. *cast iron fastenings* at 4½c. per lb.			344 52
1,056	*Wrought iron screw bolts and nuts* for joint chairs, weighing each 1½ lbs.		1,584 lbs.	
1,056	*Wrought iron washers* for ditto, $\frac{9}{16}$ lbs. each,		594	
			2,178	
	Carried over,			$9,601 54

	Brought forward,	$9,601 54
2,178 lbs.	*wrought iron bolt fastenings*, at 12c. per lb.	261 36
8,448	*Brad headed wrought iron spikes*, for middle chairs and intermediate fastenings, at 4¼ oz. each, 2,247 lbs.	
2,247 lbs.	*wrought iron spike fastenings*, at 9c. per lb.	202 23
1,056	*Zinc washers*, 10 to the lb.—106 lbs. at 10c. per lb.	10 60
	Workmanship.	
320	rods of workmanship in laying the track, at 2,75 cents, per rod lineal,	880 00
	Total per mile of single track,	$10,955 73

Such is the cost of a road upon the plan described, and with the prices assumed; but as some of these are higher than are now actually being paid by the Baltimore and Ohio Railroad Company to their contractors, the cost to that company will not probably exceed $10,000 per mile of single track, notwithstanding all the materials used by them are of the very best quality.

Comparative cost per mile of single track of several railway superstructures, compiled from B. H. Latrobe's pamphlet on his projected Z rail.

1.	New Jersey Railroad,	T rail	38 lbs.	per yard	$10,700
2.	Boston and Worcester,	T rail	38½	do	10,637
3.	Baltimore and Susquehanna,	H rail	58½	do	11,556
4.	Stonington and Providence,	H rail	58	do	11,149
5.	Long Island,	H rail	56½	do	10,587
6.	Boston and Providence,	H rail	55	do	10,352
7.	Baltimore and Ohio, (track of 1838,)	H rail	52	do	10,354
8.	Philadelphia and Reading,	H rail	45⅝	do	9,451
9.	Camden and Amboy,	H rail	45	do	9,114
10.	Newcastle and Frenchtown,	H rail	43½	do	8,736
11.	Washington Branch,	H rail	40	do	9,519
12.	Baltimore & Port Deposite, square	rail	40	do	9,428
13.	Wilmington and Susquehanna,	U rail	40	do	8,752
14.	Projected track Baltimore and Ohio Railroad,	U rail	45	do	9,927
15.	do	Z rail	45	do	9,482
16.	do	Z rail	35	do	8,169
17.	Track (of 1841) above described, Baltimore and Ohio Railroad,	U rail	51	do	10,956
					17)168,869
	Average cost per mile of seventeen tracks,				$ 9,933

As it has now been officially announced that the rolled iron edge rails of the Columbia railroad "exhibit strong symptoms of coming destruction," it is a matter of great interest to ascertain as nearly as possible the amount of trade, which has produced such a result.

With this view, the writer has carefully examined the reports of the Canal Commissioners of this State, and though we must regret that the information there made public, is not sufficiently detailed to enable us to decide the question with accuracy, still we can form some approximation to the truth.

By data obtained in the reports referred to, for the years from 1835 to 1841, inclusive, we find that:

In 1835,	1,188	Engines hauled over the road, (77 miles)	10,588 cars.
" 1836,	2,493	do	24,043 "
" 1837,	2,977	do	38,064 "
* " 1838,	3,608	do	45,364 "
" 1839,	4,239	do	52,664 "
† " 1840,	4,980	do	57,520 "
" 1841,	5,720	do	62,375 "
	25,205		290,618

Now allowing the mean weight of the above Engines, including their tenders to have been sixteen tons each, and that each of the cars, including its load weighed three tons, (both of which are mere suppositions, the official documents not giving the tonnage) we find that the gross amount of the above traffic has been, *approximately*,

		Tons.
25,205	Locomotive Steam Engines, at 16 tons,	403,280
290,618	Cars, loaded and empty, averaging three tons,	871,854
	Probable gross tonnage, including 1841, say	1,275,134

The gross trade therefore, which has reduced the rails of this road to their present dilapidated condition, may be stated at *thirteen hundred thousand tons*, unequally distributed upon two tracks, but in point of fact chiefly carried by one.

From present appearances, it would not be an unreasonable inference, that ere the aggregate tonnage passed upon this double track railway, by the aid of Locomotive steam power, shall have reached the amount of *two millions of tons gross*, the destruction of the edge rails of rolled iron of the Wigan and other similar patterns, weighing

* Estimated at a mean between 1837 and 1839, the official report for 1838 furnishing no data.

† Estimated at a mean between 1839 and 1841, in consequence of the report for 1840 not supplying the information.

from thirty-three to forty-two pounds per yard, *will be complete;* or in other words, by the time that number of tons gross (with its usual distribution on the two tracks) shall have rolled upon their surfaces, the top tables of those rails will be entirely crushed off from their vertical stems, and the rails themselves rendered useless.

And it must not be forgotten in this connexion, that many miles of stone and wooden superstructure upon this same road, have already been worn out or abandoned, and hence, that our estimate of durability leans in favor of the existing rails, rather than otherwise.

Finally, as the greater part of the tonnage of the Columbia railway has probably been carried upon one track only, the experience developed in its use goes far to justify a belief, that rails of the T and H patterns, similar to those employed here, are incapable of carrying more trade upon a single track than about *fifteen hundred thousand tons, gross weight.*

James River and Kanawha Improvement.

We learn from the seventh annual report to the Stockholders, made by Judge Cabell, the President, in December, 1841, and for which we are indebted to the politeness of E. H. Gill, Esq., Civil Engineer; that this magnificent line of transport—by which Virginia is opening through the heart of her territory a cheap route for the carriage of goods, between steamboat navigation upon the Ohio and tide-water at Richmond—is actively progressing.

The Stockholders, assembled in general meeting, have resolved to memorialize the Legislature of Virginia for such an alteration of their charter, as will allow them to dispense with the railway portage of 138 miles, hitherto proposed between the head waters of the Kanawha and the James; and to substitute in lieu of it a Turnpike and Canal improvement, consisting of a continuation eastward of their steamboat navigation, an additional distance of 116 miles, by means of the New and Greenbrier rivers—tributaries of the Great Kanawha—to Greenbrier bridge, and thence by a M'Adamized road of twenty-seven miles in length to Covington, the proposed head of the canal upon the James.

This arrangement, however, is not designed to be final, for they propose eventually to complete across the Alleghany, *a continuous canal navigation for boats of sixty tons burden!* and meanwhile only to use the turnpike portage of twenty-seven miles.

By the plan of 1838, the James and Kanawha improvement would consist of

	Miles.
Canal from Richmond to Covington,	239
Railroad from Covington to Loup Creek Shoals on the Great Kanawha,	138
Steamboat navigation from Loup Creek to mouth of Great Kanawha,	88
Total length,	465

By the plan of 1841, the James and Kanawha improvement would consist of

	Miles.
Canal from Richmond to Covington,	239
Turnpike from Covington to Greenbrier bridge,	27
Steamboat navigation from Greenbrier bridge to the mouth of the Great Kanawha,	204
Total length,	470

From the report of Mr. Gill, the surveying Engineer, sanctioned by the approbation of Benjamin Wright, Esq., their distinguished Engineer in chief, it appears that the estimated expense of executing the plan of 1841, does not exceed that of 1838, as formerly projected and estimated.

Inclusive of the charges of *freight*, *toll*, and *transhipment*, Mr. Gill estimates the expense of transporting *one ton* of agricultural productions from the confluence of the Ohio and Kanawha, to tidewater on the seaboard, by three different routes, as follows:

1. *To Richmond*, via. steamboat navigation on the Kanawha, turnpike portage, and James River Canal, $15 18
2. *To Philadelphia*, via. steamboat navigation on the Ohio to Pittsburg, and thence by Canal and two railway portages through Pennsylvania, $22 82
3. *To New York*, via. Ohio Canal, Lake Erie, Erie Canal, and Hudson river, $24 78

If these calculations should be found correct in practice, the extraordinary fact will be developed, *that the cheapest line of transportation for the carriage of heavy freight, between the valley of the Ohio and the sea, lays through the interior of Virginia.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Explosion of the Boiler of the Steamboat Citizen. By Thos. Ewbank, Esq.

TO THE COMMITTEE ON PUBLICATIONS.

On Monday, the 7th inst., as the steamboat *Citizen* was preparing to tow a packet ship from one of the docks of this city, her boiler exploded; according to some persons present it was blown into "a thou-

sand pieces." Of them a solitary fragment is all that is left, the rest fell into the water. The boiler was placed fore and aft upon the deck, and with the exception of the engine and smoke pipe, every thing connected with it, including the deck, was swept overboard. Three or four persons were wounded, two seriously, but none killed.

Supposing you might wish to add this explosion to the list kept by the Institute, I have sent the annexed sketches of the boiler, taken from plans in possession of the maker. It will be seen that its construction was similar to that of the Ohio, Gibbon, and New England. It was made of one quarter inch American iron, was about three years old, and had recently been thoroughly repaired. The *immediate* cause of the disaster is said to have been a deficiency of water. The engine was not in motion at the time. The usual strength of steam employed was fifteen inches; but on some previous occasions it had been raised to forty inches. The Engineer was a fresh hand, having been on board but a few days. From the effects produced, there can be little doubt that the steam was pretty *high;* and from the construction of the boiler and lack of water, the vertical flue within the steam chimney was most likely overheated and collapsed.

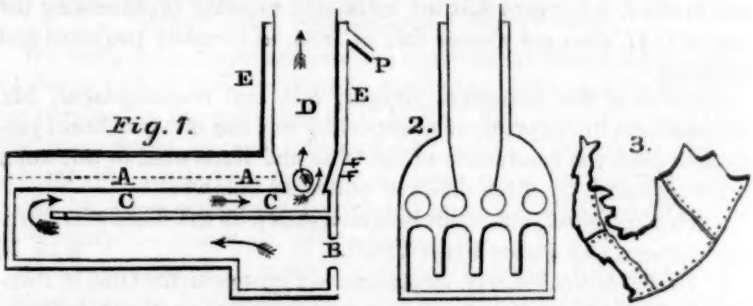


Fig. 1.

Fig. 1, is a longitudinal section. B, one of the openings for the fire doors. C, C, a horizontal flue terminating in the vertical one D, which was surrounded by the steam chimney E, E. The arrows show the direction of the smoke and flame. A, A, the water line. P, the steam pipe. There were four return flues all terminating in the vertical one.

Fig. 2, a section across the front end of the boiler.

Fig. 3, the only part of the boiler left. It does not exceed five or six feet in any direction. Some patches are on it and part of two new plates, recently put in. No part seems much worn. Two or three interior braces remain attached. The boiler was about sixteen feet long and eight feet wide. The horizontal flues were cylindrical and about sixteen inches diameter.

This is another proof of the correctness of the opinion of the Committee on Explosions respecting such boilers, and I am afraid many more will yet have to be recorded.

Very respectfully,

THOS. EWBANK.

New York, February 10th, 1842.

Explosions in Smelting Furnaces.

Translated for the Journal of the Franklin Institute, by Prof. Jno. F. Frazer.

The Annales des Mines, for January 1841, contains an interesting note upon certain explosions which have taken place in smelting furnaces, in the department of Ardennes, while employing the hot blast with baked wood.

Five explosions, of which three were very serious, took place in the course of three years; the last four occurring in rapid succession. Of these five, the last two are described in detail.

At the furnace de la Commune, on the 18th December, 1840, during the evening, half an hour after the casting, a current of gas rushed violently from the lower part of the furnace above the crucible. A loud detonation was heard. Two men who happened to be in the direction of the current were thrown down and burned. Three other workmen were greatly injured. The buildings connected with the establishment were set fire to. Upon examining the circumstances of the furnace before the explosion, it was found that the apparatus had been working irregularly for eight days previously, that the charges descended by successive falls, and out of forty or fifty that were thrown in in the twenty-four hours, four or five presented this irregular action. Each sudden descent was accompanied by a jet of gas which rose higher than usual above the throat.

During this period of eight days, the embrasure of the tuyere was completely closed, as has been for some time customary in many establishments.

A few hours before the casting which preceded the accident, the iron being completely gray, about 250lbs. of ore were thrown in by the tuyere, at different intervals, in order to whiten it.

An hour before the casting, there came a slag, very fluid, black, and charged with oxide of iron, which generally indicates a fall of the ore. At this time, the tympe was closed preparatory to casting, and for this purpose the crust of slag was suffered to harden. Nothing peculiar was observed at the tuyere; the blast was strong and steady; the casting was made. The three openings for casting, are disposed vertically. The middle one was opened and the iron run out—the same was done with the lower, and the crucible emptied within a few pounds. After a few minutes, when they wished to close completely the middle orifice, by pushing back the slag which had accumulated in contact with the plate, and introducing a clay plug, they again obtained a copious issue of iron.

A quarter of an hour afterwards a new charge was thrown into the furnace, this descended rapidly: a second was thrown upon it. The flame issued from the throat with great velocity and rose very high. It was then that the flames were perceived in the crevices of the furnace throughout its whole height. Gas entered by the tuyere, and escaped, burning, from the mastic-joints of the air-pipes. The crucible being entirely closed, the flames did not shew themselves at the tympe.

A few moments before the accident, the founder thought that he perceived that the nozzle of the air-pipe was obstructed. He thought that the slag had accumulated too high upon the iron, and went to the tympe to break the hard crust. As soon as he had withdrawn his poker, he perceived a powerful current issuing from the opening which he had made, and hurried to the flood-gate in order to diminish the velocity of the wheel, and consequently the quantity of air—the explosion took place before he reached it.

The gas, issuing from the narrow orifice which the founder had made, projected before it both iron and slag. The crucible was emptied, and the ground covered an inch deep with slag. The gas knocked down the workmen, who fell in the midst of this red hot mass, and at the same time covered them with fused iron and cinder. At the throat nothing remarkable was seen; from 100 to 120 lbs. of ore and charcoal were thrown out of the furnace. By this explosion, the air-tubes were broken, and the air ceased to enter the furnace. At three o'clock in the morning, there were about six charges short, the most of which had been thrown out of the tympe. The furnace was then filled with charcoal and closed. Two days afterwards it was again put into action, after every thing had been repaired. When I visited it, it was working very well; the charges descended regularly and without sudden falls. They were working with open tuyeres. When I inquired into the behaviour of the furnace during the two months preceding the accident, I found that before the period of eight days, which has been described, a cooling had taken place in the apparatus. The slag had got into the tuyere and diminished its section; the quantity of air introduced into the furnace was less than usual. Not more than thirty charges were introduced within the twenty-four hours, in place of fifty. They had worked for nearly two months, without detecting this obstruction, finally it was discovered, and things restored to their proper condition.

The accident at the furnace de la Fade happened three weeks after that which we have described, but no one was injured by it. A powerful explosion took place, not by the tympe, but by the throat, upon the eighth of January, after the evening casting. M. Lagard, the proprietor, to whom I had communicated the result of my observations at the other furnace, desiring to examine whether any obstruction had taken place in the furnace, suffered it to cool.

The hot air apparatus had required repairs, and the furnace had been working for several days with the cold blast. The accident happened three days after the resumption of the hot blast—thirty-six hours before the accident the charges descended more rapidly than usual; and upon the day of the explosion, (which took place at five o'clock, in the afternoon,) from eleven until one o'clock, the filler could no longer keep pace with the working of the furnace. He was assisted by another, and four charges were introduced in succession. With this exception, up to the moment of casting, the furnace worked steadily. During this period also, an alteration was made in the charge. The charge of baked wood was increased to five-sixths in place of four-sixths, which had been before used, and the proportion of charcoal

was proportionally diminished. At about half-past four o'clock, in the evening, the gases at the throat were peaceable and their flow feeble. A minute before the explosion, a projection took place at the tuyere (the embrasure had always remained open;) the gases which enveloped the hot air apparatus detonated, and a current of gas issued from the tympe. The projections then began from the throat, and lasted for nearly two minutes. The furnace was almost entirely emptied. At this time, also, the flames issued from the crevices and interstices of the masonry.

Upon an examination of the interior of the furnace, there was found no trace of any permanent obstruction, by semi-fused masses cemented to the inner walls of the furnace.

Both these furnaces were similar in their dimensions; both worked easily fusible ores in fine grains, yielding about forty per cent. of cast iron; both used as the combustible, a mixture of charcoal and baked wood (or rather dried wood, for it rarely loses more than thirty per cent of its weight.)

M. Sauvage, the Engineer, to whom we owe this account, attributes these explosions to the evolution of gases from the wood, within the cavities which form in the furnaces during the irregular action described. The intense heat finally gives to these gases sufficient tension to burst suddenly the opposing barriers, and thus the explosions take place.

An account of a similar accident which occurred upon the 24th of December, 1840, at the furnace of Vanvey, Department Côte d'Or, is given by M. de Nerville. It would seem that in this case, the effect was due to the very irregular action of the hot-air blast, which was heated only by the combustible gases conducted from the furnace throat. The heat given to the blast must consequently vary materially with the quantity of gas issuing from the furnace.* The explosion took place from the tympe.

"The examination of the facts which preceded and followed this unfortunate accident, does not permit us to doubt, that the projection of the matters contained in the crucible was solely due to the fall of a large mass of the ore not yet deprived of water, upon the liquid iron and slag. A vault had formed in the furnace, and that there existed a large empty space below it, is evident from the fact that after the accident, the ore and charcoal contained in the furnace was so thrown down, as to present at the throat a depression of nearly six feet. It may easily be conceived that the fall of such a mass into the crucible would force out iron and slag, and cause the instantaneous formation of steam."

* The apparatus, arranged at the tunnel-head, to collect the gases, presented, moreover, the disadvantage of preventing the proper arrangement of the ore in the furnace, which instead of being evenly distributed, was piled up around the walls.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Strength of Iron Wire at a low Temperature.

The following experiments were made with iron wire $\frac{1}{16}$ inch in diameter, subjected to direct strain:

	At 50 Fahr.		At Zero.
1st experiment broke with	215 lbs.	-	214 lbs.
2d " "	210 "	-	200 "
3d " "	212 "	-	206 "
4th " "	200 "	-	204 "
5th " "	210 "	-	218 "
6th " "	208 "	-	226 "
7th " "	218 "	-	200 "
8th " "	210 "	-	204 "
9th " "	224 "	-	228 "
10th " "	216 "	-	206 "
11th " "	216 "	-	220 "
12th " "	226 "	-	202 "
Mean,	214	Mean,	211

JOHN M. BATCHELDER.

Saco, Maine, Feb. 24th, 1842.

Physical Science.

Notice of a Spiral Magnet, by which Secondary Currents may be demonstrated in the body of the Magnet. By CHAS. G. PAGE, M. D., *Washington, D. C.*

More than three years since, while investigating the action of *closed* secondary currents, I was led to the conclusion that these currents must be developed in the body of the magnet itself, as well as in the coils of metal surrounding the magnet. (See Silliman's Journal, vol. 35, No. 2, page 255.) Prof. Henry, engaged about the same time in a similar train of investigations, had arrived at the same conclusion.

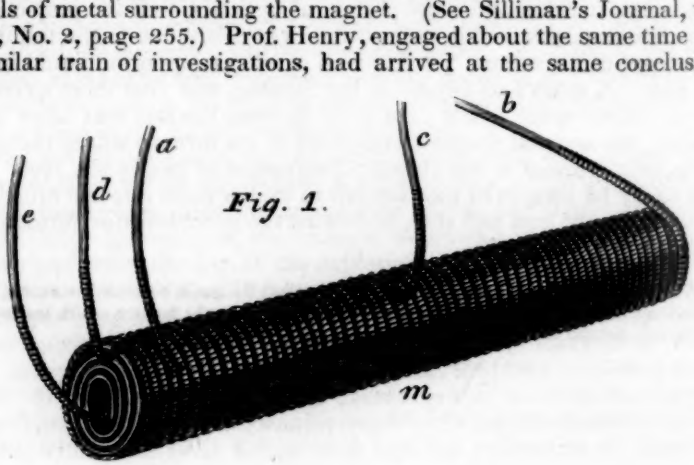


Fig. 1.

We had both, however, been anticipated by the conjectures of Prof. Ettinghausen, of Vienna. Since that time the existence of these currents has been regarded only as a matter of reasonable inference, and I know of no attempts to elicit and demonstrate them by the common tests. In the experiments above alluded to, I failed to detect these currents, from the want of a delicate Galvanoscope; but the magnet about to be described, affords currents of sufficient magnitude to be appreciated by shocks and bright sparks.

The magnet *m*, fig. 1, consists of a long sheet of very thin iron, rolled up in the form of a cylinder, and covered with three layers of insulated copper wire, the ends of which are soldered to the single wires *a*, *b*, for the purpose of communication with a galvanic battery. A sheet of paper is rolled up with the sheet of iron to insulate the several turns of the spiral. The wire *c* is soldered to the middle of the outer edge of the sheet; the wire *d* is also connected with the outer edge. The wire *e* is connected with its inner edge.

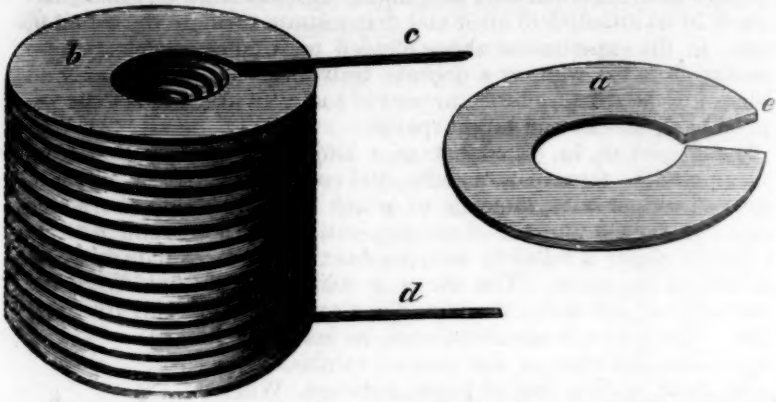
Fig. 2, is an end view of the magnet exhibiting its spiral turns, with a fold of paper between. When the wires *a* and *b* are connected with the poles of a galvanic battery, the inclosed sheet of iron becomes a strong magnet. When the galvanic connexion is broken, a brilliant spark occurs, showing a power in this respect, superior to that of a solid bar of iron. If the ends of *d* and *e* be joined, a momentary current is obtained both at the completion and the rupture of the galvanic circuit. If *e* and *c* be joined, the current is much stronger than from *d* and *e*. It appears from this, that the wires *d* and *e* conduct the currents from only a single transverse section of the magnet, while the currents from *e* and *c* are constrained to deviate from their natural course, viz. at right angles to the axis of the magnet, and take an oblique direction from one angle of the sheet to the middle of the opposite edge. The direction of these currents I have ascertained is in conformity with the law of secondary currents, as follows:—The initial secondary is in opposition to the primitive current, the terminal secondary in the same direction with the primitive.

Description of a new plate, or quantity, Helix, for Electro Magnetic Apparatus. By Chas. G. Page, M. D., *Washington, D. C.*

The design of the new helix, is firstly to obtain a maximum of magnetic influence, by surrounding an iron bar with the greatest possible number of circumvolutions of conducting metal within a given space, and to bring those conducting circuits as near as possible to a direction at right angles to the axis of the magnetic bar.

Secondly, the plate helix affords a means of modifying magneto-electric currents, so as to obtain the maximum of their magnetizing influence. I have therefore called this a quantity helix, to distinguish

it from helices of wire, in which the magnetizing property of the currents diminish in a certain ratio to the extent of wire employed.



When a magnetic bar is to be covered with copper wire wrapped with silk or cotton, it is evident that the *double* thickness of the insulating material, increases the obliquity of the wire to the axis of the magnet, besides occupying space which should be given to the conducting metal. The round form of the wire also, necessarily involves much waste room. The conditions requisite to the full economy of magnetizing power seem to be well answered by the plate helix. *a*, fig. 2, represents one of the plates of which the helix is composed. It is an annular plate of copper, about three inches in diameter, the opening in the centre being from three quarters to an inch in diameter, to admit the magnetic bar. The plate is cut open at *e*, and one of these cut edges is soldered to the edge of a similar plate, and thus the series continued to any extent desired. Upon the upper surface of each plate a piece of thin paper of the same size and form is fastened with varnish, for the purpose of insulation. *b* represents the helix with the copper wires *c* and *d* attached to its extremities. I have not yet fully ascertained the value of this helix, but from the experiments already made with it, am confident it will answer my expectations. It magnetizes powerfully, gives brilliant sparks, and will be a valuable instrument for exhibiting the magnetic effects of mechanical electricity, as it can be stretched open to an extent which will not allow the electricity to pass from one plate to another, except in the direction of continuity.

Franklin Institute.

The Annual Meeting of the Institute was held at their Hall, January 20th, 1842.

Thomas Fletcher, Vice President, in the Chair;
George W. Smith, Recording Secretary, P. T.

The minutes of the last meeting were read and approved.

Donations were received from the Hon. Charles Brown, Member of Congress; the Young Mens' Mercantile Library Association, of Cincinnati, Ohio; Prof. Alex. Dallas Bache, Jno. D. Koecker, John White, Charles B. Trego, Prof. Walter R. Johnson, Charles Ellett, Jr., A. D. Chaloner, M. D., Henry R. Campbell, the Select and Common Councils of the City of Philadelphia, Andrew Fountain, A. Pardee, Zebeelon Parker, of Newark, Ohio; Calvin Olds, of Marleboro', Vt., and from the Estate of John Ronaldson, Esq., deceased.

The Corresponding Secretary laid on the tables the periodicals received in exchange for the Journal of the Institute.

The annual report of the Board of Managers was read and accepted, and referred for publication.

The Treasurer presented his report of the funds for the last quarter, and also a statement for the year ending December 31st, 1841—which were read and accepted.

Mr. Henry R. Campbell, from the Committee of Tellers of the annual election for Officers and Managers of the Institute, for the ensuing year, (appointed at the preparatory meeting this day,) presented their report of the result of the election, when the Vice President declared the following gentlemen duly elected:

SAMUEL V. MERRICK, President.
ISAIAH LUKENS, THOMAS FLETCHER, } Vice Presidents.
ISAAC B. GARRIGUES, Recording Secretary.
ALEX. DALLAS BACHE, Corresponding Secretary.
FREDERICK FRALEY, Treasurer.

Managers.

Abraham Miller,	Henry D. Rogers,
John Struthers,	Ambrose W. Thompson,
Matthias W. Baldwin,	George Taber,
John Agnew,	Thomas U. Walter,
John Wiegand,	John H. Towne,
Samuel Hufty,	James Hutchinson,
John C. Cresson,	Edwin Greble,
Andrew M. Eastwick,	David S. Brown,
Isaac P. Morris,	Paul W. Newhall,
Charles B. Trego,	Thomas S. Stewart,
John S. Warner,	William B. Fling,
William Hart Carr,	Joseph Yeager,

(Extract from the minutes.)

THOMAS FLETCHER, *Vice President.*
GEORGE W. SMITH, *Rec. Secr'y., P. T.*

Eighteenth Annual Report of the Board of Managers of the Franklin Institute, of the State of Pennsylvania, for the promotion of the Mechanic Arts.

The Board of Managers beg leave to present their eighteenth annual report:

On retiring, it becomes the duty of the Board to render an account of their proceedings during the past year. The details of the operations of the past year must determine whether on the retrospect we can perceive a steady advance in the primary objects of the Institute. The Spirit of the Age is onward, and although there has been, and is much to embarrass and depress it, in which the Institute has largely shared, yet we think we see around us a sure guarantee, that our future course must be onward, in imparting knowledge in the various *able* modes employed by the Institute, and thereby usefulness to society and the world.

The great increase of Lectures by the various Associations, who have followed the example of the Institute in this respect, would naturally have led the Board to expect a decrease in attendance upon those of the Institute. This has, however, not been experienced; and they are fully satisfied, that could the accommodations for the classes be enlarged, the attendance would be much increased.

The Professors of the Institute have fully sustained the high opinions that have been expressed of their Lectures, and it is but justice to acknowledge the obligations, under which the Board and the Institute are placed to them.

The courses for the season are in progress as follows:—General Chemistry, on Monday evenings, by Prof. John F. Frazer. Mechanics and Natural Philosophy, on Wednesday evenings, by Prof. John C. Cresson. Chemistry as applied to the Arts, on Friday evenings, by Prof. James C. Booth. Prof. Thomas U. Walter has completed a course on Architecture, occupying Thursday evenings.

In addition to the above, Prof. Frazer has volunteered a course on Geology, which now occupies the evenings of Thursday. Doct. W. Beck Diver is delivering a course of Lectures on China, on Saturday evenings; by this arrangement, there are five courses of Lectures in each week now in progress. The Board have also to report that S. S. Halderman, Esq., has kindly volunteered to deliver a few Lectures on Zoology.

Under its new organization, the Committee on Publications have succeeded in adding very considerably to the interest of the Journal, and much praise is due to the gentlemen who have so liberally consented to act as Collaborators, and who have so freely contributed their time and labour to enhance the value of this publication. It would be a source of great gratification to the Board, could they note as much in the extent of its patronage, (particularly from the members of the Institute) as they can in its merits.

From the Committee on Science and the Arts, we learn that the number of subjects or inventions connected with Mechanics and the useful Arts, examined by that Committee through their Sub-Committees, during the past year, is seventy-three; of these, thirty remained from the year 1840, and forty-three were new; but twelve subjects remain undisposed of from the year just past.

Four medals and premiums have been awarded to ingenious inventors from the Scott's Legacy Fund, under authority from the City Councils. By a recent ordinance, the award of these medals and pre-

miums is continued with the Managers of the Franklin Institute, for a further period of seven years.

The Cabinet of Minerals belonging to the Institute continues to receive attention, being properly classified and arranged, and is constantly increasing by the addition of new specimens received as donations, or in exchange.

At their stated meeting in November, the Board enlarged the committee, having charge of this department, and authorized a division of the committee into two branches; one to have cognizance of such matters as relate more particularly to *Geology*, while the other, as heretofore, will attend to *Mineralogy*.

The Geological branch of this committee have commenced the arrangement of a Cabinet of Specimens, illustrative of the Science of Geology, in a room which has been appropriated and fitted up for this purpose, and which, with some further extension of shelves and cases, will be sufficient for the reception of an extensive suite of specimens.

It is believed, that from the resources already within the reach of the committee, together with such aid as they expect to receive hereafter, such a collection will be formed as will be creditable to the Institute, and highly instructive to those of our members who are desirous of studying this interesting branch of useful knowledge. As a means of further increasing this Cabinet, it is hoped that such of the members as possess, or may obtain, specimens of rocks, fossils, and minerals, either useful or curious, will be willing to contribute their aid towards rendering the collection still more complete and extensive.

Of the meteorological instruments made under the direction of the Committee on Meteorology, each of the counties of the State has been supplied with a set, except three. This omission is occasioned either by a difficulty in getting the instruments transported, or in procuring suitable persons to volunteer to take charge of them. From twenty-six to twenty-eight counties make regular monthly reports, and these counties being distributed in every part of the State, afford ample means of estimating the modifications of climate and other atmospheric changes in the various portions of our Commonwealth.

In addition to the reports received from our counties, a number are regularly addressed to the committee from gentlemen interested in the subject, residing in various sections of the Union.

A table of means from the reports, furnished by observers, has been regularly published monthly, since January 1839.

Of the original appropriation furnished by the State for Meteorological purposes, the balance on hand, December 31st, 1841, amounts to $429.84.

The monthly conversation meetings, under the care of the committee on monthly meetings, continue to attract the attention of the members of the Institute. It is believed that the usefulness as well as the interest of these meetings, may be considerably extended by an increased exertion on the part of the members of the Institute. As the committee is now organized, every member may add to the means of instruction.

The committee on the Cabinet of Models are steadily increasing the

collection under their charge, and have them so arranged, that they can be examined at any time by the members. The rooms are much frequented by strangers visiting the city.

The collection under the charge of the committee on the Cabinet of Arts and Manufactures, is yet in its infancy; but the committee have succeeded in procuring a very valuable and interesting collection of specimens of the progress of the Arts. As it is intended to embrace all the branches of manufactures, the attention of the members of the Institute is particularly requested to furnish specimens from their establishments, as well as from other sources.

As the Institute for several years past, have been in the practice of holding their exhibitions of American Manufactures, but once in two years, the committee on Premiums and Exhibitions during the past year have not had any special business to claim their attention.

The Library committee have devoted their attention to their appropriate duties, and during the past year, the increase has been by purchase, seventy-six volumes; donations, 126; exchange, 119; in all, 321 volumes.

The Drawing School, under the superintendence of Mr. William Mason, is extending the benefits to be there obtained to forty scholars. The well known ability of the gentleman, to whom this department of instruction is committed, needs no comment from the Board.

In the death of our late lamented President, James Ronaldson, Esq., which occurred on the 29th day of last March, the Institute lost a much valued friend.

During the past year eighty-five new members have been elected; 152 have resigned, and as near as can be ascertained, ten have deceased.

The following gentlemen have become life members:—James Crissey, Thomas Betton, M. D., W. J. Lewis, Wm. Hemble, Thos. Hunt, Wm. F. Geddes, George Snider, J. C. Montgomery, S. C. Henszey, George Taber, Jas. T. Allen, George W. Cross, and John G. Clark.

JAMES H. BULKLEY, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Minutes of the Board of Managers.

At a meeting of the Board of Managers, held January 26th, 1842,

FREDERICK FRALEY, Esq., was elected Chairman of the Board for the ensuing year; and

Messrs. JOHN S. WARNER, and EDWIN GREBLE, Curators.

At a subsequent meeting, the following Standing Committees for the ensuing year were appointed:

On the Library.

Thomas S. Stewart, *Chairman.*
Ambrose W. Thompson,
Isaac P. Morris,
Thomas U. Walter.
Joseph Yeager,
Alfred L. Elwyn, M. D.
Robert Lindsay,

On Geology and Mineralogy.

Charles B. Trego, *Chairman.*
Isaiah Lukens,
Abraham Miller,
Samuel Hufty,
Henry D. Rogers,
James C. Booth,
John F. Frazer,
Richard C. Taylor,
John H. Towne.

On the Cabinet of Models.

Isaac P. Morris, *Chairman.*
John Agnew,
Andrew M. Eastwick,
Thomas S. Stewart,
William B. Fling,
John M'Clure.

On the Cabinet of Arts and Manufactures.

James C. Booth, *Chairman.*
Charles B. Trego,
John Struthers,
John H. Towne,
Edwin Greble,
John F. Frazer,
Joseph Saxton,
James C. Hand,
Lewellyan S. Haskell.

On Publications.

John C. Cresson, *Chairman.*
Alex. Dallas Bache,
Samuel V. Merrick,
Matthias W. Baldwin,
Isaac P. Morris.

On Premiums and Exhibitions.

Samuel V. Merrick, *Chairman.*
John C. Cresson,
Alex. Dallas Bache,
Thomas Fletcher,
John Struthers,
John S. Warner.

On Instruction.

Alex. Dallas Bache, *Chairman.*
Frederick Fraley,
John Wiegand,
Charles B. Trego,
Paul W. Newhall.

On Monthly Meetings.

Roswell Parke, *Chairman.*
John C. Cresson,
Robert Hare, M. D.,
Thomas Fletcher,
William H. Carr,
James Hutchinson,
George Taber,
Joseph Saxton,
Albert W. Metcalf.

On Meteorology.

G. Emerson, M. D., *Chairman.*
John C. Cresson,
Roswell Parke,
Henry D. Rogers,
Owen Evans.

On Finance.

Samuel V. Merrick, *Chairman.*
Frederick Fraley,
Matthias W. Baldwin,
David S. Brown,
John Wiegand.

Managers of the Sinking Fund.

Samuel V. Merrick, *Chairman.* David S. Brown,
Frederick Fraley, Paul W. Newhall.
Matthias W. Baldwin,

Auditors.

Isaac B. Garrigues, *Chairman.* William Hart Carr.
Ambrose W. Thompson,

(Extract from the minutes.)

FREDERICK FRALEY, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

COMMITTEE ON SCIENCE AND THE ARTS.

Baxter's Hot Air Engine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a plan for a Hot Air Engine, invented by Mr. Morris Baxter, of Marshall county, Illinois, REPORT:—

That Mr. Baxter proposes to obtain a moving power from the expansive force of air, heated in suitable reservoirs, and allowed to act on pistons after the manner of steam. So far as the committee can learn, there is no reason to doubt that the idea of this *hot air* engine is original with Mr. Baxter, and that he supposed himself to be the first discoverer of a new source of power. The first duty of the committee was to disabuse him of this error, by shewing what has been proposed by Dr. Arnott, and other inventors of similar schemes.

This ungracious task being accomplished, the present inventor desires the opinion of the committee as to the merit of his peculiar mode of applying the principle to practice. The only peculiarity suggested in this case, is that of condensing the air into one-quarter, or any smaller fraction, of its natural volume, before subjecting it to heat. By this means it is supposed that less heat will be required to raise its temperature through any given thermometric range, that the bulk of the machine will be materially reduced, and that, possibly, some gain might arise by using a series of expansions, beginning with a tension of six or eight atmospheres, instead of two or less.

There can be no doubt, that if this species of engine should ever be brought into use, some advantage would arise from the greater compactness attained by using the air in a condensed state, and that some small saving of heat would be caused by the diminished bulk of the solid parts of the engine; but the experiments of M. M. De la Vive and Marcet, shew that the capacity for heat of all elastic fluids, increases with their density, and that consequently, a pound of air will require the same heat to raise its temperature through any range, if it occupy but one cubic foot of space, as it would if expanded to 100 feet.

The remaining part of the enquiry is whether the effect produced by the elastic expansion of a gas is proportional to its initial density, or varies according to some function of the density differing from a sim-

ple proportion. This question resolves itself into the mathematical determination of the sum of all the ordinates representing the elastic force at different periods of expansion, which is equivalent to the area of the logarithmic curve. A member of the Institute, well known for his mathematical acquirements, has kindly furnished the committee with a solution of this problem, in which it is demonstrated, that from the constancy of the subtangent of the logarithmic curve, the area of the curve is simply proportional to the value of the ordinate representing the density, and therefore, no gain can arise in this respect from using air condensed previous to heating.

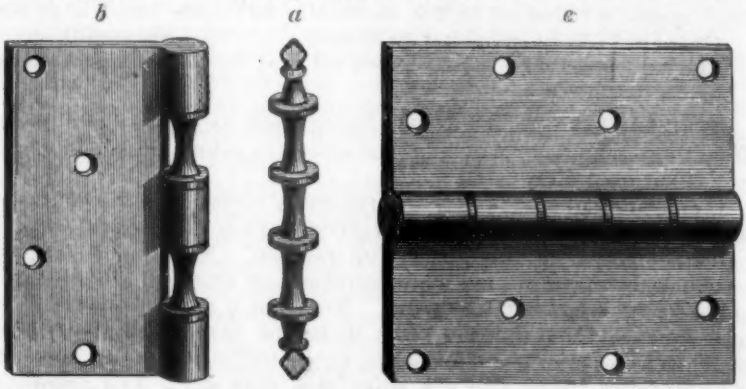
By order of the Committee.

February 10*th*, 1842. WILLIAM HAMILTON, Actuary.

Shepherd's Cast Iron Butt Hinges.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination Cast Iron Butt Hinges, invented by Mr. Thomas Shepherd, and manufactured by Mr. William Hart Carr, of Philadelphia, Pennsylvania, REPORT:—

The hinges submitted to the inspection of the committee comprised all the principal forms used in building. They are composed entirely of cast iron, and in this respect, differ from the kinds fabricated abroad; these latter hinges being generally furnished with pins or spindles of wrought iron. The hinges made by Mr. Carr are cast into com-



plete form by three operations: the first of these is to form the spindle *a*, which is effected by casting rods of metal into suitable lengths for use, which rods resemble a string of obtuse cones, joined together by their apices and bases. These are broken into proper lengths for the hinges intended to be cast, and by an adjustment of the mould, and filling up the interstices between the cones with sand, one half of the hinge *b*, is cast over the proper portions of the spindle, leaving the protected parts thereof uncovered by the flow of melted metal. The remaining half is then cast in a mould, adjusted so as to permit the introduction of the portion already fitted to the spindle, and by the application of a

suitable paste, the melted metal poured into the mould to complete the hinge *c* is prevented from adhering to those parts which are required to form the opening and turning parts of the hinge. They are then ground and finished in the usual manner for market.

From some trials of the strength of the hinges made by Mr. Carr, as compared with the best article of English manufacture, particularly in reference to the ability of the spindle to bear a blow or strain, the committee is of opinion, that they are fully equal in those respects to the foreign article.

And from the fact communicated to the committee, that they can be furnished at as low a price as those coming from abroad, they conceive the ingenuity and skill evinced in their fabrication to be worthy of high praise.

The whole process of manufacturing the hinges appears to the committee to be new, and to furnish by its results an article extensively useful in buildings of a very substantial character; and in form and style, very creditable indeed to the gentleman who have embarked in its manufacture.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

February 10th, 1842.

Corrosion of Iron in Steam Boilers and Stove Pipes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the Corrosion of Iron in Steam Boilers and Stove Pipes, where Anthracite is employed as fuel, REPORT:—

That they have gathered such information as lay in their power from those who have witnessed the corrosive action, and combined it with their own observations.

It appears that stove-pipes are frequently corroded in the course of a year or two, where they are not taken down or cleansed subsequent to their employment through the winter season. An instance is known in which forty feet of pipe were corroded and rendered a perfect colander in the course of two years. Nor does it appear always as a necessary condition that the place should be damp, although this is the case in a majority of instances, for in the corrosion just noticed, the proprietor stated that the stove was very dry. The corrosion rarely happens in an upright pipe, but usually in one lying horizontally, for where such corrosion had already commenced it was said, in one instance, to have been obviated by giving the pipe a slight inclination. Where it takes place in an upright pipe, it may arise from the flowing down of corroding matter from a horizontal layer of the same.

The same kind of corrosion is observable in steam boilers in which anthracite is employed as fuel, and not in those in which bituminous coal is used. That it does not arise from the intensity of the heat is shown from the fact, that it is greatest in the boiler-flues which lie horizontally at a distance from the fire. A corrosion is sometimes ob-

served near the top of the smoke pipe in steamboats, but this may be attributed to the alternate action of heat, cold, air, and moisture.

It would appear then, that the corrosion is caused either by the vapors arising from the combustion of anthracite, or from matter carried up mechanically by the draft; or from both combined. That it does not proceed from uncondensable gaseous matter is proved by the occurrence of the corrosion only when a stove-pipe is no longer exposed to these vapors during the summer season, or where a boiler is cooled from intermitted fires. It does not arise from matter carried up mechanically, for this could only be ashes, and we know that the ashes of anthracite is of a dry nature; and without moisture, chemical action, or the corrosion, could not occur. It must, therefore, be produced from condensable vapors.

On examining the interior of a stove-pipe lying horizontally, whether corroded or not, we find a loose ashy deposite of a greyish brown color; and where corrosion has taken place, the greater part is condensed into a solid mass, showing that it had absorbed water. Upon fracturing the solid material, small white crystals appear under the microscope, which are generally too imperfect to admit of recognising their form. By subliming the mass, a little empyreumatic oil and water are formed, but the greater part sublimed is an ammoniacal salt. Upon testing a solution of the ashes, it shows a large content of muriate and sulphate of ammonia, the former evidently in much greater quantity than the sulphate. After complete sublimation at a red heat, the ashy matter remaining appears to be nearly pure charcoal or lamp black, with a mere trace of coal ashes. From the qualitative tests made, it would appear that the ammoniacal salts constitute at least three-fourths of the whole mass. A mere trace of iron was detected.

From this content of saline matter, as well as from its nature, we are at no loss to account for the corrosion of iron where the air and moisture add their conjoint action; but it may be doubted whether the ashy matter has the power of absorbing moisture from an atmosphere of ordinary dryness, for in dry situations, it appears that there is usually no corrosion, and in the case noticed at the commencement of the report, it may be doubted whether the stove was dry.

How to obviate the corrosive action is a more difficult point to determine, unless the very simple process be resorted to, of cleaning out stove-pipes every spring, and boiler-flues every few weeks. If the stove-pipes are required to remain standing with the sediment in them, then a previous internal coating of white lead, litharge, or red lead might probably answer the best purpose, since it would result in the production of chloride and sulphate of lead, while the ammonia would be driven off. The thin coating of these salts of lead might then prevent the contact and farther action of the ashy deposite. Experiments made at the U. S. Mint during the winter of 40—41, seem to show that a coating of lime on the interior of a pipe prevents corrosion, and it is said that a few stove manufacturers in this city are acquainted with the fact. The committee, however, in the face of these facts, are rather inclined to believe that the oxide of lead will prove more efficient, since the sulphate of lead is a wholly inert salt, and the chloride

nearly insoluble, while the sulphate of lime is somewhat soluble, and the chloride of calcium very soluble, and therefore likely to produce corrosive action eventually. Still the operation of whitewashing is the simplest mode of obviating corrosion, and may be repeated at intervals.

The content of chlorine to such an extent as is developed by the above chemical examination, is interesting in a geological point of view, since it has not hitherto been found in chemical examinations of anthracite. Prof. H. D. Rogers, in 1836, pointed out the fact, that where heaps of refuse matter were burned near the coal mines, ammoniacal salts, and among them muriate of ammonia are sublimed, and may be found among the ashes. Now we know that saline waters are obtained from the coal measures in the western district of Pennsylvania, and moreover, it is the prevailing opinion among Geologists, that the coal series are marine deposites; we can therefore explain the origin of the muriate of ammonia in the ashy deposite arising from the combustion of anthracite, by attributing the chlorine to the presence of a trace of chloride of sodium (common salt) in the coal or its accompanying slate, or possibly in both. It is unnecessary to allude to the formation of ammonia, since it is a universal product to a greater or less extent of the dry distillation or combustion of every kind of coal.

This ammoniacal deposite is interesting in an economical point of view, since it accumulates in considerable quantity in a single season, and may be collected with facility. In one instance at least, ten pounds were removed from about eight to ten feet of pipe, which was the produce of three or four years, and hence, we may estimate the large amount that might be obtained from many hundred pipes in Philadelphia every season. It may be employed either for the manufacture of sal ammoniac by a very simple process of sublimation with a small quantity of a salt of lime, or it may be directly applied in powder or in solution to garden-soils. The influence of ammoniacal salts in promoting luxuriant vegetation has long been known, but the admirable work of Prof. Liebig on Agricultural Chemistry, has more completely developed their influence and importance. The material before us will unquestionably prove of great value to the gardener and florist, if properly applied to the soil; but it must not be forgotten that it is very rich in ammonia, and should therefore be employed sparingly.

By order of the Committee,

February 10th, 1842. WILLIAM HAMILTON, Actuary.

Baldwin & Vail's Locomotive Engine.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination a six wheeled, geared, Locomotive Engine, intended for the transportation of heavy freight trains, manufactured by Messrs. Baldwin & Vail, of Philadelphia, Pennsylvania, REPORT:—

That the sub-committee appointed to examine the above mentioned engine, met upon the Columbia railroad on the 25th of January,

1842, and went with the engine out to the Schuylkill bridge, and returned with it to Broad street, drawing a train of burthen cars, the gross load being about 200 tons, which was much below the limit of the engine's power, but included all the cars that were then ready to be brought in.

The peculiarity of this engine consists in its obtaining the adhesion of the four wheels of the truck, in addition to that of the main driving wheels, without preventing the truck from vibrating so as to accommodate itself to the curves and undulations of the road. Experience upon the American roads, as far as known to this committee, proves that engines having six wheels and provided with leading trucks, move much more steadily than those with only four, and, as a partial loss of power and other injurious consequences result from the slipping of the driving wheels of locomotives, (which often occurs to a considerable extent, even when it does not prevent the engine from drawing its load, and is not noticed by the engine-man) it is very desirable to obtain the adhesion of all the wheels, without losing the advantages of a vibrating truck.

The difficulty in doing this arises from the fact, that when the engine stands on a curve, the axles of the truck wheels are not parallel to that of the main driving wheels. Messrs. Baldwin & Vail obviate the difficulty in the following manner. A pair of main driving wheels, forty-four inches in diameter, are placed behind the fire-box, as in their well-known form of engine, but the axle, instead of being cranked, is straight, and the connecting rods from the pistons of the cylinders have outside connexions;* and attached to the same wrists are other connecting rods, extending forward and giving motion to a shaft under the front part of the boiler and between the axles of the truck, which shaft is secured so as to maintain its parallelism with the axle of the main driving-wheels, at right angles to the axis of the boiler. On the middle of this shaft a cog wheel is fixed, having chilled cogs slightly rounded on the face, which, by means of two intervening wheels, give motion to others on the axles of the truck. The four truck-wheels are thirty-three inches in diameter, and the gearing is proportioned so as to make them travel at the rate of the larger wheels.

The steam cylinders are thirteen inches in diameter and sixteen inches stroke. The gross weight of the engine in running order is 29,980 lbs., which is apportioned so that 11,755 lbs. are on the two points of contact with the road behind the fire-box, and 18,225 lbs. on the four points of contact under the truck. When tried upon the Columbia railroad in the presence of the committee, the engine drew its train readily around curves of 757 feet radius, the rounded surfaces of the chilled cog gearing allowing the axles of the truck to suit themselves to the curvature of the track. The engine passed with ease around a curve of ninety degrees, having a radius of 312 feet, the train being detached, and afterwards backed itself around a curve of seventy-five feet radius without difficulty.

The engine has since been in use upon the Reading railroad, and it appears from a certificate of Mr. Nicolls, the Superintendent, that on

* This improvement is applicable to engines with cranked axles.

the 12th of February, it drew from Reading to the Columbia railroad, a distance of fifty-four miles, a train of 117 loaded freight-cars; the cars weighing 215, and the freight 375 tons, making a gross load of 590 tons. The speed when in motion being ten miles per hour.

In the opinion of the committee, this engine combines in a high degree the advantages of a vibrating truck with the use of the adhesion of all the wheels; they think it well worthy of the attention of railroad companies doing a freighting business, and believe that it will add to the deservedly high reputation of the builders.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

February 21st, 1842.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN DECEMBER, 1840, AND JANUARY, 1841.

With Remarks and Exemplifications by the Editor.

51. For improvements in *Valves for the Pneumatic Railway*, applicable to other purposes; Samuel Clegg and Jacob Samuda, Sidmouth street, Gray's Inn lane, Middlesex county, England, December 31.

The subject of this patent is a mode of rendering air-tight the valve which closes up the slot, through which passes the connexion between the carriages of the pneumatic railway and the piston working in the cylinder, and which is applicable to machinery in general, in which such connexion is required. These valves work on a hinge of leather attached to one side of the slot, and the other falls into a trough filled with a composition of bees wax and tallow, or bees wax and oil so compounded as to be solid at the usual temperature of the atmosphere, and fluid a few degrees above it. The valve is opened by the connexion between the piston and the carriage, or other body outside, and falls back after it has passed, and is pressed again in its place by a roller, or other body, passing over it; and this is followed by a heated body of metal, which melts the compound, and hermetically seals the valve.

Claim.—"We do not claim the precise size or form of the various parts, or the using of the precise materials herein described; but we claim exclusively the method of constructing and using valves as herein above described, for rendering available the application of direct tractive force, either on railways or otherwise."

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1. For a mode of *Graduating the velocity of moving bodies*; Edwin W. Jackson, Albany, New York, January 5.

This patent is obtained for a mode of regulating the velocity of moving bodies, which are subjected to the influence of an irregular or

accelerating force; such for example, as cars on an inclined plane, falling bodies, carriages drawn by restive horses, &c. &c. The apparatus employed consists of two concentric cylinders, connected together at their ends by flanches, with a space between them which is separated into equal compartments by partitions, provided with apertures, the capacity of which may be regulated by valves or shutters. Quicksilver, shot, sand, or water, is to be put into this space, in sufficient quantity to fill about one third of the compartments. To turn this double cylinder with a velocity greater than that with which the quicksilver, or other substance, runs through the apertures in the partitions, sufficient power must be applied to lift the whole contents; and it will be evident that by increasing or diminishing the capacity of the apertures, the facility with which it may be made to revolve will be regulated.

Claim.—"What I claim as my invention is, the mode of graduating the velocity of moving bodies by means of a changeable weight, such as quicksilver, water, sand, shot, &c., contained in receptacles of any given form arranged around or between two concentric cylinders or wheels, and communicating with each other by apertures in the partitions or divisions thereof, through which the changeable weight passes as described. I also claim the mode of regulating the velocity of the moving body by means of valves or shutters, which enlarge or diminish the size of the apertures through which the changeable weight passes."

We are very apprehensive that this extra amount of load will rarely be carried for the purpose of obtaining its regulating influence, and that there are but few situations in which it could be applied with any advantage.

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2. For an improvement in the *Horse Power for driving machinery;* Edmund Warren, city of New York, January 5.

The improvement claimed under this patent is in the mode of connecting the sweep or lever with the master wheel, or with its shaft, so as to prevent breakage by any sudden jar applied either to the sweep or to the machinery. A disk is attached to, and is made to turn with, the shaft of the master wheel, directly under the sweep; and this is provided with two bow springs on opposite sides of its upper surface; the sweep turns on the shaft, but is keyed down so near to the surface of the disk that it cannot turn without bending the bow-springs, which are so regulated, that when the sweep is pressed against them with the constant force necessary to carry the machinery, they do not yield, but when the horse makes a plunge, or the machinery is suddenly obstructed, they then yield, and the sweep passes around without any injury to the machinery.

The claim is to the "combination of the disk, or main wheel arranged as a disk, with the springs upon it, and the lever as a means of relief, or to prevent breakage of machinery."

3. For improvements in the apparatus for *Steering Boats;* Russell Evartz, Madison, New Haven county, Connecticut, January 5.

The steering chain in this apparatus, is made fast to a segment of a wheel at the rudder head, and passing thence, its ends are wound around, and made fast to two drums on a horizontal shaft, under the tiller house—the distance between the two drums must be equal to the diameter of the wheel at the rudder head; the chain, therefore, always acts upon the wheel in the line of its tangent, and the leverage on the rudder will be unvarying. The shaft of the tiller wheel, which has its bearings in a sliding frame, is provided with wheels of different diameters, either of which may be put in gear with a cog wheel on the shaft of the drums to which the steering chain is attached. Two chains are made fast to the rudder, and pass along under the gunwales to the bow, where they are attached to the windlass, by which arrangement the vessel may be steered in case of a fire, which would prevent the use of the tiller or rudder head.

Claim.—"What I claim as my invention, and desire to secure by letters patent, consists in attaching a segment grooved wheel to the head of the rudder, around which the steering chains are passed, and to which they are made fast in such manner that the purchase shall always be at right angles to the diameter, in combination with the grooved drums on the horizontal shaft, around which the steering chains are wound, one on each side, and the gearing for turning said drums at a quicker or slower speed, by the arrangement of the cog wheels in the sliding frame, as described. Also, the arrangement of the life chains leading from the rudder to the windlass, along the gunwales, as before described."

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4. For improvements in the *Blast Furnace for smelting Iron Ores,* with bituminous or with anthracite coal; Stephen Chubbuck and Jedediah Briggs, Wareham, Plymouth county, Massachusetts, January 9.

The improvement in the blast furnace which is the subject of this patent, consists in keeping the melted iron, after it has run from the furnace into a basin provided for it, at the desired temperature by means of a fire on each side of said basin, and under the same arch which covers it. The fires on the sides of the basin communicate with a flue at the side of the smelting stack, which flue is provided with a damper at top, which, when closed, directs the draught through the stack.

Claim.—"What we claim as our invention, is the mode of keeping the metal in its liquid state to a proper degree of heat, by means of fires surrounding the basin containing said metal, and kindled and kept alive in an arch arranged in the manner described; and in combination with the foregoing arrangement, the flue governed by a damper, so operated as to permit the draught from the fires in the arch to ascend the flue, or when closed, forcing it into the smelting stack, as set forth."

5. For a machine for *Cutting Raw Hides or leather into strips* for making Ropes; Philip B. Holmes and William Pedrick, Charlestown, Middlesex county, Massachusetts, January 9.

The claim expresses the character of this invention so clearly, that we deem it unnecessary to add any explanatory remarks.

Claim.—"Having thus described our improvements, we shall claim as our invention, reducing or cutting hides, or other similar materials into long bands or strips, by means of a revolving table, in combination with a circular or other proper shaped cutting knife, attached to a movable carriage over the same; said knife being caused to pass from the circumference towards the centre of said table, by the action of a revolving screw or similar apparatus, so as to describe a spiral or curved cut through the hide on said table, as the same revolves; the whole being arranged and operating together substantially in the manner as herein above described and set forth. We also claim the supporting of the periphery of the hide above the revolving table, while the circular knife operates thereon, by means of a platform attached to the knife frame through an elongated slot, in which platform the knife is inserted, and acts on the hide resting on the same, the whole being arranged and operating substantially as described."

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6. For an improvement in *Springs for Railroad Cars*, Locomotives, and other vehicles; William Duff, city of Baltimore, January 9.

The patentee says—"My invention consists in the particular manner in which I have combined and arranged the elastic spring made of steel plates, with any desired number of spiral springs, by which arrangement I obtain a high degree of elasticity, and graduate the action of the spring in accordance with the varying burthen which it is to sustain."

The plate springs are arranged and constructed in the usual way, and the spiral springs are placed either between the upper surface of the plate springs and the under surface of the side of the main truck, locomotive, or car, frame; or between the upper surface of the last mentioned side piece and the lower part of the frame of the body. The spiral springs are coiled around rods which pass through the first mentioned side piece, and rest on the upper surface of the plate springs.

Claim.—"What I claim, is the manner in which I have combined the steel plate springs, as constructed with scrolled ends, or with ends attached to vibrating bars, or to be received into pockets, with the spiral springs, which are so graduated in length as to be successively brought into action, according to the bearing of the load, as described."

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7. For a method of operating the working *Valves of Steam Engines;* John Wilder, city of New York, January 9.

An arrangement of levers for working the valves of steam engines, is to be made within the steam chest, and these are to be operated by the rod. The valve has a conical seat, and may work on a stem to insure its working truly. The main lever is jointed at one end to the

lifting rod, and at the other to the centre of the valve; and at its middle to a second lever which embraces it, and which has its fulcrum in a line with the joint, which unites the first lever and lifting rod, when the valve is closed.

The claim is to the "combination of the lifting rod, principal lever, and the second lever, with the eduction valve."

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8. For an *Hydraulic Wheel for Raising Water;* Pierre Désiré Henry, city of New Orleans, Louisiana, January 9.

This wheel is a modification of the well known hydraulic wheel for raising water, which receives the water in bent tubes at the periphery, and discharges it near the centre. It is to be made much narrower at the periphery, where the water is received, than near the shaft, where it is discharged. The space between its inner and outer peripheries is divided into compartments by partitions tangential to the inner periphery. These compartments are made to open at both ends; the openings at their outer ends, or at the outer periphery of the wheel, are provided with valves opening inwards, to admit the water when submerged, and to prevent its escape when leaving the reservoir, or lifting the water contained in the compartment. The water is to be discharged into a proper reservoir, or gutter. When the wheel is employed to raise water from a shallow place, a spoon or scoop is adapted to its outer periphery to catch the water.

The claim is to the "arrangement of the tubes or compartments for conducting the water to the gutter, in combination with the valves governing the inlets of the compartments; and also, in combination therewith, the spoons or scoops for scooping the water up when the basin is low."

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9. For improvements in *Railroad Cars;* John A. Whitford, Saratoga Springs, New York, January 20.

The claims made under this patent refer throughout to the drawings.

The first improvement claimed is to an arrangement of parts by which the two trucks of a car are connected with each other, and with two windlasses, one at each end of the car, by means of which the axles of the wheels are to be thrown in the direction of the radii of the curve of the road. Each truck is provided with two racks that mash into two pinions, one on each side of the car frame; from the axis of each of these pinions extends an arm, to the outer end of which is affixed a chain that passes around the drum of a windlass at each end of the car. By turning either of the windlasses the axles are thrown out of their parallelism, and as the two trucks are connected by the racks with the two pinions, when one axle is shifted the other is shifted also.

The second improvement claimed is to the making of the axles in two parts, which are coupled together in the middle by means of a pipe, or ferule, in combination with a mode of adjusting them by

means of a pointed screw passing through a slide in each box, the head of which is cut into ratchets to prevent it from turning, a spring pall being applied thereto.

The third and last improvement claimed is in the combining two additional bow springs with the common spring. The two additional springs are arranged under the truck frames, one forward, and the other back of the pedestal, the ends bearing against the under side of the frame, and a bolt passing through the middle of each, and the side piece of the truck, and made fast to the ends of the main spring above, which bears on the boxes of the friction rollers that slide in the upper part of the pedestal—this car being so arranged as to have the bearings of the axles run on friction wheels.

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10. For a *Shingle Cutting Machine;* Truman Walcot, Stow, Middlesex county, Massachusetts, January 20; patent dated the 5th of September, 1840.

The improvement described in this machine consists in an arrangement of the parts of the carriage, by which the block is fed up to the knife at every upward movement of the knife gate. From the back of the carriage project two "toothed gauges," the teeth of which engage, alternately, with two *shippers,* which are connected with, or relieved from, the teeth of the gauge by two cams on the arbor of a ratchet wheel, which is turned by the gate at each upward movement. When the shippers are relieved from the cams they are drawn back against the teeth of the gauges by a spiral spring.

The claim is to the "combination of the ratchet wheel, cams, shippers, and toothed gauges."

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11. For an improvement in the *Seed Drill, or Corn Planter;* Calvin Olds, Marlborough, Windham county, Vermont, January 20.

This machine resembles a wheelbarrow, excepting that the shafts extend beyond the wheel to receive the necessary apparatus for forming the drill, &c. The circumference of the wheel is to be equal to the distance between the hills, it being provided with a projecting piece to mark the hills. On the axle of this wheel is another of less diameter, called the cup wheel, it being provided with a cup to receive the seeds from a shoe, or hopper, and discharge them into a spout, which drops them in a drill directly in front of the marking wheel. The cup wheel is movable on the axle of the dropping wheel, for the purpose of adjusting the two, to insure the marking of the place where the seeds have been dropped.

Claim.—"What I claim as my invention, and desire to secure by letters patent, consists in the arrangement of the cup wheel on the axle of the marking wheel, so as to render it adjustible, as described."

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12. For an improvement in the *Argand Lamp;* Benjamin Hemmenway, Roxbury, Norfolk county, Massachusetts, January 20.

The object of this improvement is to avoid the necessity of remov-

ing the oil chamber, in the fountain lamp, to replenish it with oil. The fountain or reservoir is supplied with oil through a short pipe at top, which is hermetically closed by a leather valve and screw cap; and between the bottom of this reservoir and the pipe that conducts the oil to the burner, is an air chamber, which is supplied with air by a tube passing up through the oil reservoir. From the bottom of the oil reservoir a tube, provided with a stop cock, descends to within a short distance of the bottom of the air chamber. When the oil chamber is to be replenished, the stop cock, in the tube at the bottom, must be closed, and the valve at the top may then be opened to receive the oil; and when the valve at the top is closed, then the stop cock may be opened. When this has been done, it is evident that the air from the air chamber will rise in the tube, at the bottom of the reservoir, and allow the oil to descend in the air chamber until it reaches the lower end of the said tube, and the oil reservoir being then hermetically closed by the valve at the top, the atmospheric pressure will prevent the farther descent of the oil. By this arrangement the inconvenience arising from the overflowing of the common fountain lamp is effectually guarded against, for by making the top of the burner a little higher than the lower end of the tube in the bottom of the oil reservoir, the oil can never rise above the given height.

Claim.—"I claim combining with the air chamber, in the manner set forth, a tube for admitting air to said chamber, and a stationary fountain or reservoir for containing oil, constructed as described; that is, having a tube to admit of a supply of oil when necessary, with a cap adapted to said tube, to exclude the pressure of the air, and a tube for conveying the oil to the air chamber, provided with a stop cock to intercept the communication while the fountain is being filled."

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13. For a *Safety Barge and Army Boat;* Solomon C. Batchelor, Cincinnati, Ohio, January 20.

For Specification, see vol. 1, page 114.

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14. For *Driving Machinery by the Foot;* Aaron Clarke, Greenwich, Fairfield county, Connecticut, January 20.

The machinery described by the patentee, is intended for driving silk reels, and for performing any light work, by means of a horizontal band wheel, and bands communicating with the machine to be driven.

The foot by which the wheel is to be turned, is to be passed into a shoe, which is connected to a crank pin on the face of a wheel, in such manner as to enable the operator to turn the wheel, which amounts simply to working a crank, or winch, by the foot, instead of by the hand.

It seems that there was novelty enough in the device, according to the judgment of the patent office, to justify the affixing its seal thereto; but we apprehend that the utility of the invention will not be sufficient in amount to render the purchasers of rights very numerous.

The claim is to the combination of the pin on the horizontal wheel, the oval block, and the shoe attached thereto.

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15. For an improved manner of constructing *Railroad Car Bodies;* George S. Hacker, Charleston, South Carolina, January 21.

This car body is to be cylindrical, and the patentee says:—"I am aware that carriage bodies for transportation of the mails, have been made cylindrical and hooped; but when thus constructed, the parts could not be tightly drawn by driving the hoops, and therefore I do not claim this as my invention. But what I do claim as my invention, and desire to secure by letters patent, is the construction of the body of a railroad car in the form of a barrel, hooped in the manner and for the purpose described."

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16. For an improved *Door Spring;* Samuel Sawyer, Boston, Massachusetts, January 21.

The object of this improvement is to increase the force with which the spring shall act on the door, as it closes, instead of decreasing it, as is the case with the springs generally employed. This is effected by increasing the leverage of the mechanism on which the spring acts.

At the upper part of the door is a pin which turns freely in a case, and around which is coiled a spring, attached by one of its ends to the pin, and by the other to the case. From the upper end of this pin projects an arm, at right angles, the outer end of which is jointed to a bar connected with the frame of the door by a joint at its other end. By this arrangement the tension of the spring acts on the pin, the arm of which, by its connexion with the bar above named, gradually increases its leverage as the door closes, and gradually decreases it as it opens.

The claim refers throughout to the drawings, and could not be understood without them; it is limited to the particular arrangement of parts above indicated.

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17. For a method of *Manufacturing Balls of Caoutchouc*, or India Rubber; Edwin M. Chaffee, Cambridgeport, Middlesex county, Massachusetts, January 21.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the making of balls from caoutchouc, by chopping it fine or otherwise reducing it to small pieces, and separating and heating the same by throwing it into hot water, and afterwards pressing it in a mould constructed as above described."

The mould employed in this process consists of a hollow cylinder, the bottom of which is concave, and semi-spherical, and to said cylinder a piston is fitted, the lower end of which is also semi-spherical to correspond with the bottom of the cylinder. A hole is made in the bottom of the cylinder, and another through the piston, for the escape of

the water which is forced out in pressing. The proper quantity of the material being put into the mould, the ball will be readily formed.

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18. For improvements in *Corsets;* Elizabeth Adams, Boston, Massachusetts, January 21.

We make the following extracts from the specification.

"I do not intend my invention to be worn for the purpose for which the common corsets or stays are generally used, as it is larger both before and behind, and could not be worn in ordinary circumstances, without great inconvenience. It is to be applied to pregnant females, to support the protruded abdomen, and at the same time to allow of its increase in size, without any injurious increase of pressure, from time to time during the period of pregnancy. For this purpose I insert, in a proper manner, in the centre of the front of the corset, a wide steel spring or busk extending to the bottom of the same. The lower end of the spring or busk is curved, so as to readily to adapt itself to the distended part, and extends downwards a much greater distance than the busk of the common corset, or down to and beneath the very lowest part of the abdomen.

"On each side of the central busk is another spring or busk of less size. These latter springs are also slightly curved, in order to adapt them to the sides of the projecting abdomen. It will readily be perceived, from the peculiar shape of the several springs, that those parts of the body which are dilated during pregnancy, rest on and are supported by the same, and that any strain or weight falling upon the springs is conveyed to, and supported by, the shoulder straps.

"Steel springs, or strips of whalebone, are inserted in the body of the corset, and so secured as to support the projecting parts of the breast, and sides of the abdomen.

"Long slits, or openings, are made in the front of the corset, between the springs or busks; and these openings are secured together by lacings of common caoutchouc, or other suitable elastic cord or tape.

"I claim the combination, in a corset, of the front slits or openings, with the steel busk or spring, curved and shaped as described and represented in the drawings, so that while the said busk, in conjunction with the curved form, which it imparts to the bottom of the corset, serves to support the distended parts, the several slits in front allow the parts, as they enlarge, to expand outwards or horizontally; and the looseness of the corset above the abdomen, permits them to rise upwards when sitting or stooping."

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19. For a method of *Forming Ice;* Thomas B. Smith, St. Louis, Missouri, January 23.

The patentee says:—"My improved process for the rapid production of solid ice by the freezing of water, is dependent upon the well known fact, that a thin stratum of water when exposed to an atmosphere, the temperature of which is at, or below, thirty-two degrees of

Fahrenheit's scale, very rapidly becomes frozen. It is also a fact that after a thin sheet of ice has been formed upon the surface of water, the process of freezing proceeds but slowly, in consequence of the bad conducting property of ice for the matter of heat. Taking advantage of these laws, I proceed in the formation, or the making of ice, in the following way: I prepare a vat, or other suitable vessel, of wood, or other material, of any size that I may deem convenient, and this I place on a level, in such situation as shall best expose it to the freezing influence of the atmosphere. From any suitable reservoir I cause a portion of water to run into this vat, or other vessel, so as to cover the bottom thereof to the depth of an eighth, or fourth, of an inch, more or less, according to circumstances, and this water I allow to become completely frozen; when this has taken place, I in like manner supply another portion of water to be converted into ice. Proceeding in this way, I quickly obtain a thick stratum of ice, of perfect purity, if the water be pure, and of great solidity."

The vat, or reservoir, is described as being made with movable partitions, to form blocks of any desired size.

Claim.—"What I claim therein, and desire to secure by letters patent, is the manner herein described of rapidly forming thick sheets, or blocks, of ice, by the successive pouring of small portions of water into a vat, or other suitable vessel, allowing the same to freeze, and adding, in succession, fresh portions of water, as above set forth, until the process is completed."

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20. For a method of *Moving the Index on a Weighing Apparatus, or Scales;* Martin Robbins, Hollidaysburg, Huntingdon county, Pennsylvania, January 23.

These scales are a modification of that kind which indicates the increase of weight by elevating a weighted lever from a vertical to a horizontal line, the scale dish being suspended by a cord passing around a wheel on the axis of the lever. The drawings represent the figure of a man standing on a pedestal, between two columns, and the scale, or index, of pounds, &c., is marked on an arch based upon the columns. The two arms of the figure are the weighted levers, their axes being the shoulders, and having a wheel on each, to which is suspended the cords or chains that pass through the body and legs, and hold the dish, which hangs in the pedestal. A cord or chain passes from a wheel, on the axis of one of the arms, or weighted levers, to a wheel on the axis of the index, which axis is situated in the breast of the figure, and is the centre of the arch on which the index figures are engraved.

The claim refers to the drawings, but it is confined to the arrangement of the wheel on the axis of the index hand, in combination with the chain leading from it to the wheel on one of the weighted levers, "for causing the index hand to perform a semi-circle on the graduated arch for indicating the weight of the article to be weighed." This arrangement will make a very ornamental balance, but we are unable to perceive any feature of novelty in the apparatus which could au-

thorize the grant of a patent; the device may please the fancy, but in the general arrangement it does not differ from some other weighing machines, nor will it weigh accurately.

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21. For an improvement in the *Fire Escape;* Samuel Welsh and Thomas Linacree, city of Albany, New York, January 23.

In describing this machine the patentees say, "the machine or apparatus, which we have improved, is of that kind in which there is a box for containing persons, and such implements as they may need; which box, by the turning of a winch, may, by the power of those within it, be made to ascend, or slide up on a vertical shaft, to the height of twenty, thirty, or more feet. Said vertical shaft is, at its lower end, attached and braced to a piece of timber, which constitutes one of the axles of a carriage, upon which the apparatus is to be conveyed to and from a fire; the shaft, which is to stand vertically when in use, being then placed in a horizontal position."

The axle tree, of what are the hind wheels, when the shaft lies horizontally, is braced to the shaft on two sides by permanent braces; and to the other sides of the shaft are jointed two other braces, the lower ends of which are shod with iron, and are connected with the ends of the axle tree by adjusting bars. A pair of wheels are adapted to the other end of the shaft when it is moved from place to place. This apparatus is provided with a short ladder, with which to form a connexion or bridge between the box and a window; it has hooks also at each end and side, for greater safety to the persons ascending or descending. When the shaft is elevated the wheels are chocked by means of blocks that fit their peripheries.

Claim.—"Having thus fully described the nature of the apparatus which we employ to preserve the lives of persons, and to aid in removing property and extinguishing fires in buildings, it is to be understood that we do not claim to have invented this apparatus, so far as its general construction is concerned; but we do claim to have made certain improvements therein, by which it is rendered more convenient and efficient than it has been as heretofore constructed. We confine our claim to invention, therefore, to the particular manner of combining those parts thereof, by which it is held steadily when the shaft is being raised, and whilst it is in a vertical position; said combination consisting of the adjustable leveling bars, the movable braces, and the chock blocks, co-operating with each other in the manner set forth. We also claim the combining with such apparatus, the trough and ladder with the additional pulley for elevating and managing the same."

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22. For *Draughting and Cutting Ladies' Dresses, &c.;* Aaron A. Tentler, Philadelphia, Pennsylvania, January 23.

We shall not attempt to give a description, or the claims, in this instance, as they refer throughout to the several diagrams which are to serve as guides in the operation.

23. For a process of *Manufacturing Sulphate of Alumine;* Rudolph and Gustava Boninger, Baltimore, Maryland, Assignees of Max Joseph Funcke, of Eickelskamp, Prussia, January 23; granted for fourteen years from the 16th of November, 1839, the date of the English Patent.
(See Specification.)

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24. For an improvement in the *Corn Sheller;* John A. Whitford, Saratoga Springs, New York, January 23.

The kind of corn sheller to which the patentee refers, is that which shells the corn by means of a roller set with teeth, and working against a concave hung on springs, to yield to the different sized ears of corn. The improvement consists in the employment of a series of wheels, with teeth projecting from their peripheries, on a shaft which has its bearings in the concave. The teeth on these wheels work between the teeth of a comb attached to a plate projecting from the frame, the edge of which nearly touches the teeth of the main shelling roller. The shaft of the toothed wheels, or small sheller, has a pinion on its end, which mashes into a cog wheel, the shaft of which passes through the concave frame, and on which said concave frame vibrates, to enable the small sheller to vibrate with the concave whilst it receives its rotary motion from the cog wheel. The ears of corn are brought against the comb and plate, and there stripped of their grain, which passes out and descends an inclined board leading to a proper receptacle, whilst the cobs pass out at the side.

The claim is to the "arrangement of the lower or small sheller in the lower part of the concave, so that they shall yield together to different sized ears, as described, in combination with the upper or main sheller."

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25. For an improvement in the *Machine for making Bricks* from tempered clay; Thomas Conklin, Woodville, Wilkinson county, Mississippi, January 23.

The clay is to be mixed in a tub of the usual construction, the bottom of which is pierced with a long aperture, through which the mixed clay is forced into the moulds, as they are presented thereto, by a series of inclined arms, which are attached to the shaft of the mixing knives, immediately above the bottom of the tub. Below this bottom, the shaft of the mixing knives has a circular platform attached to, and revolving with it to receive and carry round the moulds, which are hooked on to an endless chain that passes around a drum on the above mentioned shaft, and around another at the outer end of the way on which the moulds slide. After the moulds have passed under the aperture through which they are filled, they are conducted under two weighted pressers that press the clay into them, and then under a wire striker that cuts off the surplus material. The way or platform on which the moulds slide, is provided with an inclined plane at the outer end, which lifts the moulds, and thus unhooks them from the chain.

The circular revolving platform that carries the moulds round under the tub, is pierced with large holes to allow the clay which drops from the tub and from the moulds, to fall through out of the way of the machine.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the before described arrangement of the endless chains to which the moulds are attached, and the way, guides, and inclined planes, in combination with the circular revolving platform; the mixing tub, inclined dischargers therein, pressers, striker and discharger for making bricks in the manner herein set forth—there being a continuous line of empty moulds made to pass under the discharging aperture in the bottom of the mixing tub, whilst at the same time a similar line of filled moulds are made to leave the aforesaid aperture, pressed, struck, scraped, and the moulds liberated from the chains by the inclined plane at the end of the way, and in combination therewith, the endless chain for supplying the clay as described."

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26. For a machine for *Heading Spikes;* Robert S. Harris, Wilmington, Delaware, January 25.

The proposed improvement is on the common jaws, employed to hold the spikes in heading them with a hand hammer. The jointed jaw is opened and closed by a toggle, which is connected above by a link with a spring to open the jaws, and with a treadle below to close them. In the hole of the griping dies there is a pin on which the point of the spikes rest to prevent them from driving through; this slides in a hole made in a rest which prevents it from descending too low, but permits it to slide up. The lower end of this pin is connected by a lever with the treadle, so that as the jaw is opened by the action of the spring, the treadle is drawn up, which, by its connexion, forces up the pin, and thus liberates the spike from the dies.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination of the jaw, toggle joint, and spring, for the purpose of throwing open the jaws as described, and these parts, thus combined, I claim also in combination with the treadle, rest or support, and the pin, with their connexions, for the purpose and in the manner specified."

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27. For an improvement in *Dampers or Valves in Chimney flues;* Normand Smith, Hartford, Connecticut, January 25.

We deem it sufficient in this instance to give the claim on which this patent rests, which is in the following words, viz:—"I am aware that chimneys have been supplied with valves or shutters in the throat or flue, for the purpose of regulating the opening in the throat, or entirely closing it, and therefore, I do not claim this as of my invention; but what I do claim as my invention, and desire to secure by letters patent, is the peculiar manner in which I have applied the dampers or valves, so that they can be removed at pleasure without removing any of the fixtures, to which, or by which, they are attached, by having

the pivots of the valves drop into notches, made in the iron framing, which is attached, or let into, the throat or flue of the chimney, in which they are retained by the weight of the iron valves, but from which they can be removed for the purpose, and in the manner, specified."

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28. For *Working the Valves of Steam Engines;* Robert L. and Francis B. Stevens, New York city, January 25.

The improvement which is the subject of this patent, is in the manner of working the valves of steam engines, in which the steam is to be cut off and used expansively. The following is extracted from the specification.

"Engines in which the steam is cut off, have either a separate valve or else use the steam valves themselves for that purpose; when the steam valves are thus applied, the mode hitherto used for working them has been by means of a cam wheel placed on the main shaft of the engine, which, through the intervention of a rod and rock shaft, raises and lowers the valves at proper intervals, or by means of tapets placed on the lifting rods, or on the pump rods, which last method is commonly known and described as the hand gear."

"In our improvement, (the exhaust valves being worked by any of the several methods hitherto used for that purpose,) we raise the steam valves and lower them at any portion of the stroke of the piston, by means of a separate and independent crank or eccentric wheel, giving an alternate rotary motion to a rock shaft, which by means of two toes, placed on the opposite sides of its centre of motion, alternately raises and depresses each valve. When the toes are affixed to the rock shaft so that their faces are in the same straight line, as soon as the toe on one side of the rock shaft has lowered one valve, the toe on the opposite side of the shaft begins to lift the opposite valve; in this case one valve is not closed until the other begins to open, and the steam is not intercepted until the end of the stroke of the piston; but when the toes are fixed to the opposite sides of the shaft so that their faces are not in the same straight line, but are depressed to an angle less than two right angles, after the toe on one side of the rock shaft has lowered the valve, the rock shaft will revolve through a certain interval before the toe on the other side of the shaft begins to lift the opposite valve: during which interval neither valve being raised, the steam in the cylinder will be acting expansively."

"What we claim as our invention, is the combination of an additional and separate eccentric wheel to work a rock shaft to raise the steam valves, in combination with any of the several methods hitherto used for working the exhaust valves. We also claim the manner in which the toes are affixed to the rock shaft, so that the shaft is made to vibrate during a certain interval, without either toe communicating motion to either valve. We also claim the combination of the cog wheel and rack, in the manner set forth, for the more completely effecting our object."

The last improvement claimed, is for affixing a rack on the end of the eccentric rod, to work in a cog wheel on the end of the rock shaft,

as a substitute for the eccentric hook and arm, when it is desired to give a greater amount of motion to the rock shaft.

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29. For improvements in the *Barometer;* William R. Hopkins, Geneva, Ontario county, New York, January 27.

In this improved instrument, the range, or rise and fall, of the mercury in the tube is to be ascertained by weighing, instead of being indicated by the scale usually employed. The bulb end of the tube is provided with a sack communicating with the tube, which communication may be closed when desired, by a valve and screw. When it is desired to weigh the mercury, the valve leading into the sack is closed, the instrument placed horizontally on a knife edge attached to the tube, and a scale dish suspended from the end of the tube opposite the sack.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the method of ascertaining the weight of the mercury in the barometer tube, by weighing the quantity remaining in the reservoir or cistern of the barometer. I also claim the sack and valve in combination with the barometer tube, by means of which the flow of mercury can at any time be arrested for the purpose of weighing."

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30. For an improvement in the *Corn Sheller;* Charles Willis, Chelsea, Suffolk county, Massachusetts, January 27.

This corn sheller is one of that kind which have a shelling wheel or disk furnished with teeth on both faces, and having two holding spouts; the improvement consists in having two plates, one on each side, which form the bottom, or rather, back of the holding spouts, and against which the ears of corn are borne during the operation of the shelling wheel. These plates are movable and adjustable by means of screws, so as to regulate the distance between their inner edges and the faces of the shelling disk.

The claim is to the "movable plates placed in the rear of the holding spouts, and capable of being adjusted by screws to such distances from the teeth of the rotary circular plate, as may be desirable, as described."

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31. For an improvement in the manner of forming *Blocks of Wood for Paving Streets;* James H. Patterson, city of New York, January 27.

The patentee says—"I cut my blocks rectangularly, or nearly so, in all their parts, and adapt them to each other in such a manner as that they shall interlock, and that no single block in the series which crosses a road, or street, can be pressed down without depressing the whole series; thus distributing the weight which bears upon them in one part, over the whole number. Under the arrangement here indicated, the blocks interlock on those sides only which are in contact with each other in crossing the road or street."

"What I claim as constituting my invention, and desire to secure by

letters patent, is the cutting of such blocks on two of their sides, so that they shall have four, or more, rectangular offsets, as herein described, when said blocks are intended to support each other in a straight line only, crossing the road, or street; and as it will be manifest that the principle upon which I shape my blocks may be carried out by forming a greater number of rectangular faces and off-sets, I do not intend to limit myself in this particular; but I am confidently of opinion that any change in these particulars would only render the plan of contruction more complex, without being productive of any advantage."

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32. For an improvement in the *Domestic Spinner* for Spinning Wool; John Nelson, Jefferson, Logan county, Ohio, January 27.

This patent is obtained for an improvement in the arrangement of the parts of the well known family spinner for spinning wool, and which works on the principle of the old spinning jenney. The drawing carriage has the usual rollers, apron, and clamp for measuring out the length of roving at each operation. One of the rollers has a pinion on one end, which turns freely on its axis, in one direction, and in the other carries the roller around with it by a ratchet wheel and pall. As the carriage advances towards the spindles in winding on, the ends of the spring clamp are thrown open by two wedge pieces on the frame, and then kept open by a catch; during this, the pinion on the end of the roller is passing under a rack, attached to the frame, and turning freely on its axis, but when it changes its motion and runs back, then the roller is turned by the rack and pinion which gives out the roving, the length of which is regulated by the adjustment of a trigger which disengages the catch on the clamp, and thus arrests the farther supply of roving.

Claim.—"What I claim, is the manner in which I have constructed the clamp and its appendages, making a part of the carriage, and arranged the respective parts thereof, as described, so as to be operated upon by the rack, the wedge pieces, and the trigger, in the manner, and for the purpose, set forth. I do not claim the manner of constructing the clamp, the pinion or ratchet wheel, or either of the parts taken alone, but only in their combination with each other, in the manner set forth."

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33. For an improvement in the *Curriers' Beam;* Ichabod Lindsey, Charlestown, Middlesex county, Massachusetts, January 27.

The wooden beam usually employed by morocco dressers and curriers, is rendered uneven by the action of the tanning liquor, and of the knife; and to obviate these difficulties, the patentee has substituted a slab of marble, metal, or other hard substance, for the wood heretofore employed.

The claim is to the "method of constructing curriers' beams by inserting a slab of marble, or other hard substance, in the wood, by which means the utility of the instrument is greatly improved."

34. For a *Fire Alarm;* Theophilus Goodwin, of Exeter, New Hampshire, assigned to Josiah Brown, Brentwood, New Hampshire, January 30; antidated July 30, 1840.

The above named invention is for giving an alarm in case of fire in a house, by the expansion of a bar of metal, which is to start the trigger of an alarm bell.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of the expansion of metals by heat to start an alarm in case of fire, in the manner and for the purpose described, using any of the solid metals, and applying them in any shape to produce the same effect."

A patent was granted to Rufus Porter on the 28th day of December, 1840, for an apparatus similar to this, but upon a hearing of testimony before the Commissioner of patents, the priority of invention was decided in favour of Mr. Goodwin, and the above named patent was therefore granted to him.

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35. For an improvement in the *Ink Stand;* Isaac M. Moss, of Philadelphia, Pennsylvania, assignee of John Farley, Washington, District of Columbia, January 30.

(See Specification.)

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36. For an improvement in the manner of *Discharging Fire Arms;* Joshua Shaw, January 30.

(See Specification vol. 1, p. 117.)

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37. For an improvement in the *Brick Press;* Thos. W. Smith, Alexandria, District of Columbia, January 30.

The brick to be pressed is placed upon a horizontal sliding table, which sustains a system of progressive levers of the kind usually denominated the toggle joint, by which the pressing is to be effected. The sliding table is carried forward by a rack and pinion beneath it, and the whole apparatus is arranged in such a manner as to render it both efficient and convenient. Although not complex, it would not be easy to describe its construction intelligibly without the drawings, and we will, therefore, only give the claim, which is to "the forming of the pressing mould by means of the frame, the sliding table, and the standard and follower thereon, constructed and operating as set forth. Likewise, in combination with such a machine, the distinct and independent manner of pressing the brick, and of carrying the brick forward into the pressing mould, and removing it therefrom, the whole being constructed and operating substantially as described."

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38. For an improvement in the *Gridiron* for broiling meat; Isaac Damon, Northampton, Hampshire county, Massachusetts, January 30.

This gridiron is of the usual square form, and instead of the bars

and open spaces, it is made of a crimped, or corrugated metal plate, without openings. At the back there is the usual dripping pan, and a fender is placed immediately in front of it to protect the gravy from the action of the fire.

Claim.—"What I claim as my invention and improvement upon the common gridiron, and desire to secure by letters patent, is the employment of the crimped metallic plate, instead of bars or open spaces, and also, of the fender between the dripping pan and the fire, as described."

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39. For an improvement in the *Machine for Stretching Horse Collars;* James P. Osborn, Reddington, Hunterdon county, New Jersey, January 30.

This machine consists of a metal stock, on which the collar to be stretched is put; the stock is made in two parts, which are hinged together at the larger end; and within this is placed a wooden *form*, which slides upon the bench, by the aid of a screw rod and crank. A rope is passed around the collar after it is placed on the metal stock, and is made fast to a nut that travels on another screw rod, provided with a crank. By turning the two screw rods, the two sides of the stock are forced out by the sliding of the wooden *form* within it, whilst at the same time, every part of the collar is made to hug, and take the form of, the stock by drawing of the rope.

The claim is to the "combination of the metal stock, the movable wooden form, the manner of using the rope, and the cranks and screw rods."

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40. For improvements in the *Carding Machine;* Ebenezer and Alanson Crane, Lowell, Middlesex county, Massachusetts, January 30.

The top cards instead of being permanently attached to the frame, are affixed to a traveling endless belt, passing around a roller at each end, and one at top in the middle—they are prevented from approaching too near to the main card by a segment plate, over which the ends of the pieces, forming the chain, travel. As the top cards approach the top roller, they are stripped by a stripping card attached to the ends of two "sweeps," or arms, that receive a reciprocating motion from a crank. After stripping the top cards, it passes over a small permanent card which cleans it.

The rollers and segment are provided with adjusting screws.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the attaching or fastening the top cards of the carding machine to revolving endless chains or belts, instead of securing them to the frame of the machine, and making them stationary as heretofore practiced, as described: and the application of such belts in combination with the rollers and adjusting screws and segment of a circle, to the purpose of conveying the top cards of the carding machine to, and placing them in, a position where they can be stripped by power, and the combination of the sweeps and stripping and clean-

ing cards, and crank for the purpose of stripping the top cards by power, when placed in such position as described."

41. For an improvement in the *Endless Chain Horse Power;* Jeremiah M. Reed, Middlefield, Otsego county, New York, January 30.

The endless floor of this machine is formed by the union of a sufficient number of four wheeled cars, the wheels of which travel round in the space formed by two endless railways on each side, the space being a little wider than the diameter of the whole. The cars are connected together by links jointed to their bottoms. Motion is communicated to a shaft by racks attached to the bottom of the cars.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making the endless chain upon which the horse, &c., walks by uniting together in the manner described a sufficient number of four wheeled cars, as described, and also running the wheels in the space between the two endless rails on each side, in the manner described."

Specifications of American Patents.

Specification of a Patent granted to James C. Booth, *of Philadelphia, Pennsylvania, December 5th,* 1840, *for a mode of Whitening or preparing what is termed "Fair Leather."*

Be it known that I, James C. Booth, of Philadelphia, Pennsylvania, have invented a new and improved mode of manufacturing, preparing, whitening, or making, what is termed "Fair Leather," and I do hereby declare that the following is a full and accurate description.

In order to obtain or put the leather in the state designated, so that it may have the peculiar light-colored and fair appearance which is the object of the invention, I employ it (the leather) in that stage of the manufacture when it is in its moist state, after it is "finished;" or if it is used when the leather is dry, then in the latter case it must be moistened through with clear water. While it is thus wet, I spread with a sponge, brush, or other suitable article, the following liquid composition over the fair surface of the leather, giving it sufficient dampness to let the pores absorb the liquid. The liquid to be applied, is a solution of the protomuriate of tin in muriatic acid, ether, alcohol, and water, and is composed as follows:—Any quantity of the protomuriate of tin is dissolved in about one half of the weight of muriatic acid, and to this solution ether is added in the proportion, by weight, of three times the weight of the protomuriate of tin, and then a quantity of alcohol by weight, equal to four times the weight of the protomuriate of tin. To this may be superadded clear fresh water in the proportion of three parts by weight, as compared with the protomuriate of tin.

If the leather to be employed under this process is not clear, or is very dark, or spotted, then a greater proportion of muriatic acid is to be used, say an equal quantity, by weight, or twice as much, by

weight, as compared with the protomuriate of tin. Immediately after the application of the above described liquid composition to the leather, I spread over it, in a similar manner, spirits of turpentine with or without a small quantity of tallow, dissolved in it, sufficient to make it pliable, and the leather is suffered to dry in the ordinary manner, and the operation is complete. The spirits of turpentine, alone will generally be sufficient to give pliability to the leather after the first composition is employed, without adding the tallow, but when the leather is stiff or hard, or not sufficiently soft, the tallow may then be added. The leather after this process will have the required whiteness and fair appearance.

What I claim as my invention or discovery, is the use of the protomuriate of tin dissolved in the manner, and by the liquid, above described, for the purpose of communicating a light-colored and fair appearance to leather, whether the leather be oak tanned, bark tanned, hemlock tanned, with its natural or ordinary color.

JAMES C. BOOTH.

Specification of a Patent for a Process of Manufacturing Sulphate of Alumine. Granted to RUDOLPH AND GUSTAVA BONINGER, *of Baltimore, Maryland, Assignees of* MAX JOSEPH FUNCKE, *of Eichelskamp, Prussia, 23rd of January,* 1841; *patent to run fourteen years from the 16th of November,* 1839—*the date of the English patent.*

To all whom it may concern: Be it known that I, Max Joseph Funcke, a subject of the King of Prussia, residing at Eichelskamp, in the circuit of the government of Dusseldorf, in the said kingdom, have invented an improvement in the manner, or process, of manufacturing sulphate of alumine, so as to produce the same free, or very nearly free, from iron, and from alkali; whereby it is more perfectly adapted to be used as a mordant, or for other purposes, in the useful arts, than the alum of commerce, or than the sulphate of alumine, as ordinarily prepared. And I do hereby declare that the following is a full and exact description thereof.

I take potters' clay, pipe clay, or clay of any other kind, as free from iron as it can possibly be obtained; and this I dry at such degree of heat as is necessary to drive off all its free moisture. The clay so calcined, is next to be reduced to powder, and this powder I put into suitable leaden vessels, or vessels of other material not acted upon by sulphuric acid; to these vessels a moderate degree of heat is to be applied, by means of steam or otherwise. Sulphuric acid, of 66° Beaumé, is then to be added to the clay, in such quantity as shall suffice to dissolve nearly the whole of the alumine contained in the clay; which may be ascertained by a previous test on a small quantity. An excess of acid should not be used, as the whole ought to be perfectly neutralized by the alumine.

After the addition of the acid, the mass in the pans is to be stirred until it is perfectly dry; boiling water is then to be added in sufficient

quantity to dissolve the whole of the salt. The liquid thus obtained is to be placed in vats, and to remain at rest until it becomes perfectly clear. It should then be tested by means of lime water, to be certain that it does not contain any free acid; and should any be present, lime water is to be added until the whole excess of acid has combined with the lime, and has been precipitated in the form of sulphate of lime. When perfectly clear, the liquid is to be drawn off into other vats, preparatory to the separating from it the iron, which will always be found contained with it in greater or a less quantity. A measured portion of this liquid, say one pint, is then to be taken, and the iron contained in it is to be precipitated, by means of a solution of prussiate of potash, in such manner as to ascertain the exact quantity of said solution necessary to the precipitation of the contained iron. The quantity of liquid contained in the vat being known, the portion of the solution of the prussiate of potash necessary to the precipitation of the whole of the iron will consequently be known, and this is to be added to it, the mixture stirred, and the prussiate of iron formed, allowed to go to the bottom. The liquid is then to be drawn off clear from the precipitate, and a pure, or nearly pure, solution of sulphate of alumine will be thus obtained; and it may in this state, be applied to various purposes in the arts.

If desired, the water may be quickly evaporated in leaden or other vessels, until a pellicle appears on its surface; when it may be put into suitable forms, and allowed to cool and crystalize, or consolidate.

I am aware that clay has been heretofore treated with sulphuric acid, to form a sulphate of alumine; and I am also aware that it is known to every chemist that iron may be precipitated from its solutions in sulphuric, or other acid, by means of prussiate of potash. I do not, therefore, make any claim to the discovery of either of these processes when taken alone; but I do claim the combination of means herein pointed out for the manufacturing of sulphate of alumine, by which it is produced with greater facility, and in a state of greater purity, than by any of the processes heretofore adopted in its manufacture; that is to say, I claim, in combination, the preparing of the clay by dessication, the combining thereof with sulphuric acid, and the subsequent solution and precipitation of the iron, substantially in the manner, and for the purpose, herein fully made known.

I will here observe, that although I have pointed out a solution of the prussiate of potash as the article by which the iron is to be precipitated, I have done so because I esteem this as the best mode of obtaining the end desired; but I do not intend hereby to limit, or confine, myself to the use of this salt, but to use any other of the known reagents by which a similar result may be attained, and a sulphate of alumine free, or nearly free, from alkali, may be produced.

MAX JOSEPH FUNCKE.

Specification of a Patent for an improvement in Ink Stands. Granted to ISAAC M. MOSS, *of Philadelphia, Assignee of John Farley, Washington, District of Columbia, on the 30th of January,* 1841.

To all whom it may concern: Be it known that I, John Farley, of Washington, District of Columbia, having invented a new and improved mode of using ordinary writing ink, and hereby declare the following to be a full and exact description.

The nature of my invention is such as to accomplish all the desiderata in writing: such as facility in the use of the ink, purity in the fluid, preservation from moulding, &c., by the employment of capillary attraction in the following manner, viz:—I provide the stand with an air tight stopper, which screws into the top and centre of the stand. In the centre of this stopper is a small funnel, or reservoir, communicating by an aperture with the interior. Through this aperture I insert a wick, possessing the capillary property of the sponge. The stopper being screwed down, causes the ink to rise in the reservoir for use, in a pure and limpid state, and by reversing the motion, the ink falls at pleasure, and is secured from deterioration or accident. The capillary action being an independent effect, per se, will result with or without the intervention of a tube.

What I claim as my invention, and desire to secure by letters patent, is the employment of a capillary action for the purpose of supplying the ink, as herein described, in combination with the air tight stopper, arranged and operating as above set forth.

JOHN FARLEY.

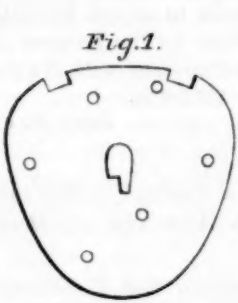
Specification of a Patent for an improved Padlock, called the Clam Shell Padlock. Granted to SOLOMON ANDREWS, *Perth Amboy, New Jersey, December 5th,* 1840.

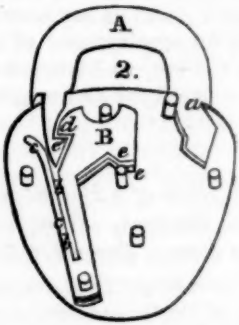
To all whom it may concern: Be it known that I, Solomon Andrews, of Perth Amboy, in the county of Middlesex, and state of New Jersey, have invented an improvement in the manner of constructing padlocks, which improved locks I denominate the clam shell padlock, and which is particularly applicable to mail, and other traveling, bags, although it may also be used for other purposes; and I do hereby declare that the following is a full and exact description thereof.

The distinguishing features of the lock, are the manner in which I construct, or form, the shell, or case, within which the key operates upon what I call the spring hooks; the manner in which I form these spring hooks, and also the way in which I connect the bow, or hasp, with the shell, or case, without the employment of a joint pin. The shell, or case, consists of two plates, or pieces of metal, only, which are struck up in the same die, and are, therefore, exactly alike in form. Fig. 1 represents one of these plates, which when laid upon, and riveted to, a corresponding plate, forms the shell, the edges of which are curved, or rounded.

Fig. 2 shows the interior of the lock, the key-hole plate, fig.1, being removed. A is the bow, or hasp, which is embraced at its joint part by the sides of the shell, and is thereby held in place, the part which enters the notch at *a* serving as the fulcrum upon which it turns; it is thus left solid, not requiring to be perforated for a joint pin. B is one of the spring hooks; of these I generally employ from four to six, placed one above the other; but any desired number may be used. I usually cut each of these spring hooks out of a single plate, with a slit, *b*, *b*, along it, so as to constitute the part *c*, *c*, a spring which admits the catch of the hasp to come under the hook when the hasp is shut, or pushed in, and hold it there until it is released by the key; and when the key forces the hook, or catch part, *d*, back, it will cause the upper end of the spring to bear against the inclined portion, *é*, of the catch of the hasp, and will cause the hasp to fly out, as soon as it is relieved from the action of the catch part of the spring hooks. The side of the key bits, (which may be of different lengths,) when turned open the lock, bears against the lips, *e*, *e*, of the spring hooks, to each of which they are adapted and fitted in a way well understood by locksmiths. When the key is not acting upon the spring hooks, or the hasp is not being pushed in so as to be held by the catch, there is no tension whatever on the spring, *c*, *c*, but it is quite free, exerting no pressure at all on the catch.

Fig.1.





Having thus fully described the construction and operation of my improved mail bag padlock, what I claim therein as constituting my invention, is: first, the forming of the shell, or case, of two pieces of plate metal, raised, and adapted to each other, in the manner set forth. I do not claim the raising of metals by means of dies, this being a well-known process, but I limit my claim to the manner in which I have adapted the raised plates to the forming of the shell of a padlock, instead of making it by casting, or by joining a rim on to wrought metal; as by this adaptation I have not only improved the form, but have given additional strength, and that at a diminished cost. Secondly, I claim the manner of combining the bow, or hasp, with the shell of the lock, without the use of a joint pin, as herein fully set forth. Thirdly, I claim the manner of forming and using the spring hooks, as described; the springs being so arranged as to be

brought into action by the shutting of the hasp, and by the turning of the key, and causing the hasp to fly out, by the pressure of the springs against the inclined point of the catch.

It will be manifest that variations may be made in the manner of forming and arranging the respective parts of the lock herein described, and I do not, therefore, intend to limit myself in this respect; the springs may be made separate, and attached to the spring hooks; and other changes of a similar kind may be introduced in other parts, whilst the instrument will remain substantially the same, producing a like result by analogous means.

SOLOMON ANDREWS.

English Patents.

Specification of a Patent granted to JOHN WILLIAM NEALE, *of Kennington, and* JACQUES EDOUARD DUYCK, *of Old Kent Road, for certain improvements in the Manufacture of Vinegar, and in the apparatus employed therein, September 8th,* 1841.

These improvements consist in the manufacture of vinegar from beet-roots; these roots, after being thoroughly washed, are reduced to the state of pulp by rasping. A number of strong cloth bags are filled with this pulp and placed in a press with a board or hurdle between them, and subjected to a powerful pressure, till the whole of the saccharine juice is extracted. The juice, which will vary in strength from about 7° to 9° of the areometer, is to be reduced to 5° by the addition of water, and boiled; the liquid is then removed to the coolers. On the temperature falling to 60° Fahr., the wort is removed to the fermenting vat, and half a gallon of yeast added for every 100 gallons of wort.

When the fermentation is over, the liquor is removed to the acidifying vessel, which is a strong vat capable of holding 24,000 gallons; in its centre, at a short distance above the bottom, there is a perforated rose, communicating by a pipe with a blowing machine. A steam worm lies at the bottom of the vat, communicating with a boiler, and furnished with a stop-cock, the other end of the worm being open to the atmosphere. The vat is divided into several compartments by perforated diaphragms, and in the cover of the vat there is a valve opening upwards.

Two thousand gallons of vinegar are first let into the vat to serve as mother to an equal quantity of fermented wash, which is next introduced, with a little yeast, when acetous fermentation quickly ensues. Air is then forced in through the perforated rose, which in its passage through the perforated diaphragms enters into intimate contact with the liquor, imparting a portion of oxygen to it, and expelling the carbonic acid gas through the valve in the vat cover. When the temperature of the liquor falls below 70° Fahr., steam is admitted to the worm, so as to maintain the temperature constantly between 70° and 80.°

In a few days the liquid will be converted into vinegar, when 4000 gallons more of fermented wash are let into the vat, and the process continued until the whole 8,000 gallons become vinegar. This course is pursued until the vat contains 24,000 gallons of vinegar, when 8000 gallons are drawn off and clarified, and replaced with 8000 gallons of fresh wash, and so on continuously.

The claim is—1. To the improved process and apparatus for manufacturing vinegar from beet-roots.

2. The process and apparatus for effecting and maintaining the acetous fermentation, and all such modifications of the same, wherein the acetous fermentation is conducted by the combined operations of an air-forcing apparatus and steam-heat applied in pipes or vessels within the acidifying vessel, whether the process of conducting the acetous fermentation be applied to the making of vinegar from beet-roots, or any other substances.

3. To the application of an air forcing apparatus in the manufacture of vinegar, or acetous acid, distinctly considered from the other parts of the apparatus.

Lond. Mechanics' Mag.

Specification of a Patent granted to WILLIAM SAMUEL HENSON, *London, for certain improvements in Steam Engines, August 16th,* 1841.

In this high pressure condensing steam-engine, the steam chambers are each furnished with an escape-valve closed by a spring; these valves are kept shut by rods and levers worked by cams on the main shaft, the pressure of which is withdrawn when the valves are to be permitted to open. Thus, supposing the piston to be near the completion of its downward stroke, the pressure is removed from the upper escape-valve, when the steam forces it open, and rushes out until the steam within the cylinder is reduced to a slight excess above atmospheric pressure, when the spring closes the valve; the upper eduction-valve is now opened, and the remainder of the steam passes into the condenser. The piston then makes its upward stroke, and the opposite set of valves act in a similar manner.

The engine is furnished with two condensers, each having a valve at the top opened by rods worked by the engine; and also a valve at bottom kept shut by a spring, but opening into a casing, which communicates by a valve opening outwards with a cold water tank. Each condenser is provided with a jet, and is inclosed in a separate cistern, having a side valve for the admission of cold water, and two valves in its base through which the water is conveyed into the casing, and thence back into the cold water tank. At the termination of a stroke, the steam is admitted through the eduction-pipe into a chamber above the condensers; the upper valve of one of the condensers being opened, the steam enters and forces out the condensation water of the previous stroke through the lower valve, escaping with it, until the steam in the chamber is in equilibrium with the atmosphere, when the spring closes the lower valve.

The upper valve of the other condenser is now opened, and the remainder of the steam admitted and condensed by the injection of cold water, producing a partial vacuum within the condenser. During these operations, the cistern of the latter condenser is filled with water, while the former is empty. Towards the termination of the succeeding stroke, the water is allowed to run off from the latter cistern, by opening its lower valve, and the jet is turned off: at the same time cold water is admitted into the cistern of the first condenser and its jet turned on. The same operations as before then take place, the order of the condensers only being reversed.

In order to guard against explosion, the patentee places a governor on the top of the steam boiler,which is connected with the safety-valve by a long lever, in such a manner, that while the engine is at work, and the governor in motion, the safety-valve is closed, but as soon as the engine stops, the governor opens the safety-valve and lets off the steam.

The claim is—1. To the application to the cylinder of a steam-engine using a condenser, or to the passages between the cylinder of a steam-engine and its condenser, of an apparatus of the nature of that described, so as to permit the escape from the cylinder, or from the steam passages between the cylinder and the condenser, during a very short interval of time near the termination of each stroke, of so much steam as will leave the remainder of the steam within the cylinder but little above atmospheric pressure, and condensing that remainder by the means ordinarily used in condensing engines.

2. To the clearing the condensers of steam-engines, in which high pressure steam is used, by the application to that purpose of part of the force by which steam, used in such engines, exceeds the pressure of the atmosphere, when combined with condensers, at intervals immersed in water, as described.

3. To the application of a governor to the safety-valve of steam-engine boilers, by which the safety-valve is raised when the engine is at rest.

Ibid.

Specification of a Patent granted to JOHN GODWIN, *of Hackney Road, for an improved construction of Piano Fortes of certain descriptions. August* 23, 1841.

The improvements here patented relate to the construction and arrangement of the different parts of horizontal pianos, the strings of which pass from the plate over the bridge on the sound-board in the usual manner, and under a bridge beneath the wrest-pin block. The strings are each passed round a separate pulley, and are then carried up in front of the block to the wrest-pins, and are secured in the usual way. These pulleys are made in sets, according as the instrument is to have two or three unisons, and the mounting of each set has a shank attached to the lower angle of the front of the wrest-pin block, which is cut away for that purpose. The wrest-pin block is of a rectangular form, (eight inches wide, and four inches deep,) and

is composed of two pieces; the lowest of which is cut away to admit a strap on one end of a bar, the other end of which is attached to the string plate. There are several of these straps, which are let in to counteract the tendency of the tension of the strings to depress the front and elevate the back of the wrest-pin block. For this purpose, an iron bolt, three-sixteenths of an inch in diameter, is also passed through each bar, through the sound-board and bracket, and secured above the bar by a nut, and beneath the bracket by a washer.

The sound-board is placed three inches and a half below the strings, and is extended two inches farther than usual towards the front of the instrument, under the vibrating part of the strings. This extension may be carried through the whole length of the scale, but it is preferred to go only as far as where the treble notes do not require dampers.

In order to effect the action of the key upon the hammer and damper, under this arrangement, the damper level is placed between the sound-board and the strings, and the bracket is made quite straight. The key is shortened about two inches, and a right angled piece of metal, fixed on the end of it, communicates the action of the key to the damper lever. The check is carried farther back on the key, and a cheek piece is attached to the middle of the shank. The hammer rest is also removed higher up, and the length between the head and the shank of the hammer is reduced to an inch. Ibid.

Specification of a Patent granted to WILLIAM EDWARD NEWTON, *of Chancery Lane, for improvements in obtaining a concentrated extract of Hops, which the inventor denominates "Humuline." August* 15, 1841.

The hops are dried till brittle in an oven heated to 86° Fahrenheit, and are then passed through a coarse sieve; this powder is placed in a close cylinder and covered with alcohol to a depth of one and a half inches, and submitted to pressure for twenty-four hours. The alcoholic tincture is then drawn off into a tub, and the powdered hops washed repeatedly in water, till no further extract remains in them.

The alcoholic tincture, and the essential oil which is combined with it, is placed in a water-bath, and the alcohol driven off, which leaves the essential oil remaining behind in the form of a brownish-yellow resin covered with a yellowish watery extract. This extract is added to the aqueous solution, and evaporated by an open fire to the consistence of sirop; it is then removed to the water-bath and evaporated to a nearly solid extract. This extract is added to the resinous matter of the alcoholic tincture in a warm state, and the compound thus produced is the "Humuline," two pounds of which are equal in use to six pounds of hops.

Another mode is to place hops, either powdered or whole, in a closed vessel, and expose them to the action of steam, when a liquid extract is obtained, which, by evaporation, may be converted into "Humuline."

The claim is to the methods herein described, of making or producing a concentrated extract of hops. Ibid.

Specification of a Patent granted to JAMES RANSOME AND CHARLES MAY, *of Ipswich, Suffolk, for improvements in the Manufacture of Railway Chairs, railway and other pins or bolts, and in wood fastenings and tree nails. August* 15, 1841.

These improvements in the manufacture of railway chairs, consist in the employment of metal side plates in the sand mould in which the chair is cast; and also in using metal cores for the cavity in the chair which receives the rail.

The second improvement, relating to the manufacture of wooden pins or bolts, consists in forcing them into moulds, (which are cylindrical tubes slightly tapered towards the mouth,) and submitting them while under compression, to the action of heat, until the natural elasticity of the wood is sufficiently overcome. The pins will then retain the form thus given them until driven into damp sleepers, when the moisture will cause them to swell, and they will become firmly fixed therein. The wood fastenings and tree-nails are treated in a similar manner.

The claim is—1. To the mode of casting railway chairs by means of metal side surfaces in sand moulds, with metal or other cores as described.

2. To the mode of casting railway chairs, by applying metal cores as described.

3. To the mode of manufacturing railway and other pins or bolts, and wood fastenings and tree-nails, by forcing them into moulds so formed as to retain them under compression till the elasticity of the wood is sufficiently overcome.

4. To the mode of manufacturing railway and other pins or bolts, and wood fastenings and tree-nails, by subjecting them to heat when under compression, in moulds as described. Ibid.

Specification of a Patent granted to JAMES WHITELAW AND GEORGE WHITELAW, *of Glasgow, for a new mode of Propelling Vessels through the water, with certain improvements in the steam-engine when used in connexion therewith, part of which improvements are applicable to other purposes. August* 15, 1841.

This new mode of propelling, consists in forcing air through openings in the bottom of the vessel, which passes in divided currents along channels or spaces inclining upward from the bottom of the vessel toward the stern, where it escapes at the surface of the water. The propelling power is derived from the buoyancy of the air—the force which it gives out, as it expands in its passage to the surface of the water—and the force from reaction which is communicated to the

vessel as the air escapes. In order to back the vessel, the air is forced out through pipes directed towards the bow of the vessel.

The improved steam-engine consists of a horizontal cylinder through the centre of which a main shaft passes, carrying two vibrating vertical fans, which together fill the diameter of the cylinders, and greatly resemble a Bramah's pump. On one side of this cylinder is another of equal size, and similarly constructed, which forms the air-pump for propelling the vessel, while on the opposite side is the air-pump of the steam-engine. The shafts are all connected so as to move together. On admitting steam to the engine, the fans make a vibratory movement, each motion of the air-pump forcing a portion of air into the channel before mentioned, along which it passes in broken currents, which the patentees consider more advantageous than a continuous current of air. Ibid.

Specification of a Patent granted to THOMAS WILLIAM BOOKER, *of Melin Griffith's Works, near Cardiff, for improvements in the Manufacture of Iron. August* 21, 1841.

For the purpose of converting cast iron from its crude state, into wrought or malleable iron, an open refinery, or furnace, is connected with a reverberatory, or puddling furnace, by a passage which terminates in its neck. The refining furnace having been sufficiently heated, a charge of about nine hundred weight of cast-iron is thrown in, and melted down in the ordinary way; when the refining process is complete, the whole charge of metal is run off into the puddling furnace, previously heated to a proper degree. The iron is then puddled in the usual manner, and divided into lumps or balls of a convenient size, which are passed to the rolling cylinders, &c., to be finished.

The principal novelty in the process consists in causing the heated metal of the refining furnace to pass directly into a puddling furnace without being permitted to become cold. Ibid.

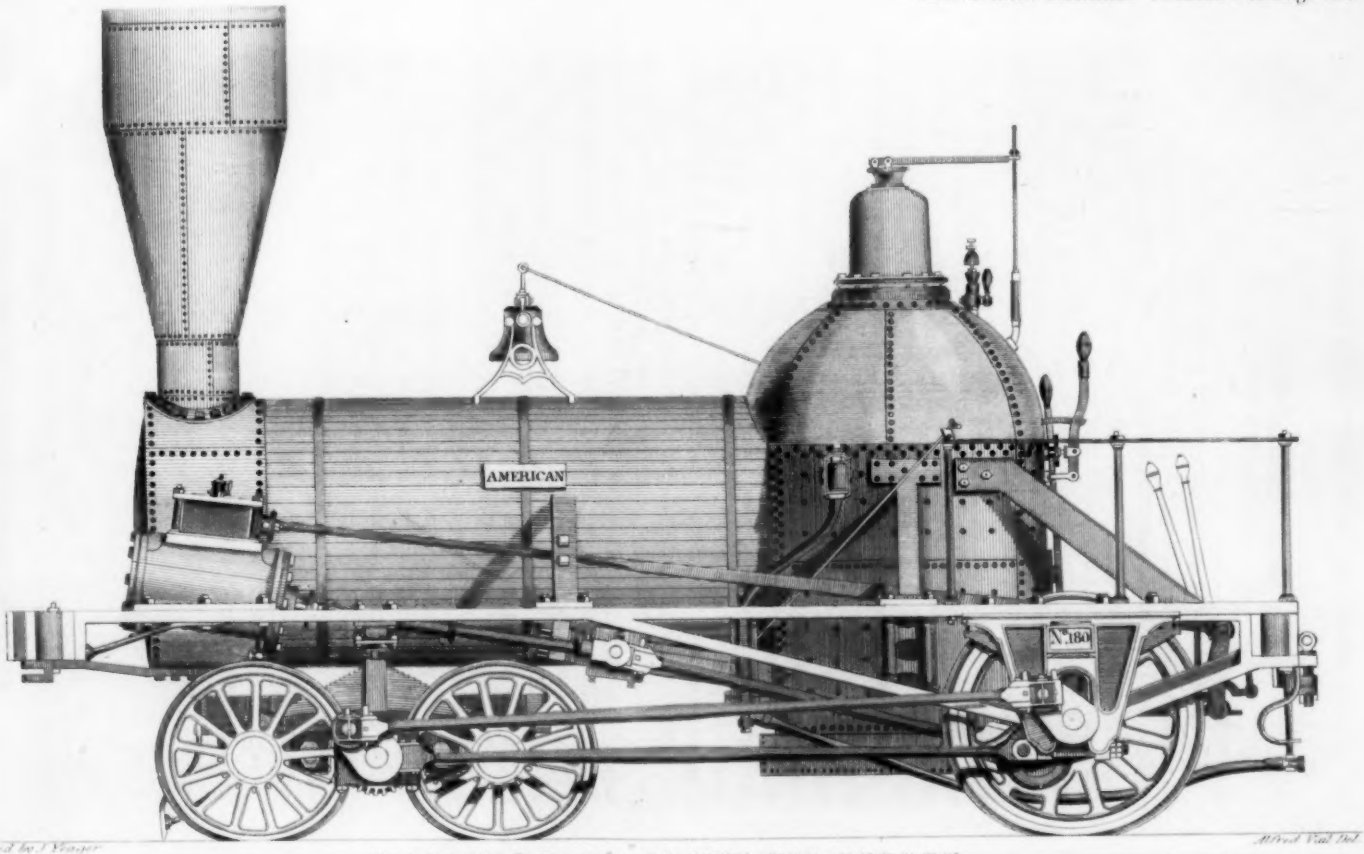
Progress of Civil Engineering.

Baldwin's Geared Truck Locomotive Engine.

Through the kindness of Mr. Baldwin, we are enabled to lay before our readers in the present number, an engraving of this new arrangement of the machinery of a Locomotive, by means of which, the wheels of the leading truck (so valuable in a curved way) are converted into drivers, without interfering with their other useful properties.

We also subjoin the letter of the Superintendent of the Reading railroad, describing a large performance made by this Locomotive on that railway; and at page 178 we insert the report of the committee of Science and the Arts, upon the merits of the peculiar arrangement of parts, by which the adhesion of all the wheels is obtained.*

* For the specification of Mr. Baldwin's patent, for the mode of accomplishing this object, see the number of this Journal for February, 1842, page 136.



Engraved by J. Yeager

Alfred Vail del.

BALDWIN & VAIL'S ENGINE BUILT IN 1837 AND 38.

PHILADELPHIA, February 12, 1842.

Messrs. BALDWIN & VAIL; Gentlemen,—I send you inclosed, a statement of the performance of your new six wheeled, geared engine, which you will perceive is in every way satisfactory. The train weighed 108½ tons, of 2,240 lbs., more than that hauled by your "Hichens and Harrison" engine in February last, on our road.*

Statement of the performance of a six wheeled engine, built by Messrs. BALDWIN & VAIL, *on the Philadelphia, Reading and Pottsville Railroad, February* 12, 1842.

This engine has six wheels and outside connexions. The large drivers (forty-four inches in diameter,) are behind the fire box, and connected with the four truck wheels, (thirty-three inches in diameter,) by cog gearing, in such a way as to obtain the adhesion of the whole weight of the engine, with little additional friction, and at the same time allow the requisite play in curves.

Her weight, in running order, is 30,000 lbs.; on her large drivers, 11,775 lbs.; or 5,887 lbs. on each. On the truck wheel 18,225 lbs. or 4,565 lbs. on each, and her cylinders are thirteen inches diameter and sixteen inches stroke.

This engine hauled, on the above date, a train of 117 loaded cars, weighing in all 590 tons, from Reading to the inclined plane, on the Columbia railroad, fifty-four miles, in five hours and twenty-two minutes, being at the rate of over ten miles per hour the whole way.

She consumed 2 $\frac{6}{10}$ cords of wood, and evaporated 3,110 gallons of water, with the above train. Weight of freight, 375 tons, of 2,240 lbs.; consisting of 259 tons of coal, twenty-two tons of iron and nails, and ninety-four tons of sundry other merchandize, including fifty-three live hogs, ten hhds. of whiskey, 188 bbls. flour, ship stuff, butter, &c. Weight of cars, 215 tons, making a total weight, not including engine and tender, of 590 tons of 2,240 lbs.

Whole length of train, 1,402 feet, or eighty-two feet over a quarter of a mile. The above train was transported in the ordinary freight business of the road, and was run without any previous preparation of engines, cars or fuel for the performance. The engine was closely watched at all the starts of the train, and not the least slipping of any of her wheels could be perceived. She worked remarkably well throughout the trip, turning curves of 819 feet radius, with ease to her machinery, and no perceptible increase of friction in her gearing. Her speed with the train on a level, was found to be nine miles per hour.

Whole length of level, over which the above train was hauled, twenty-eight miles; longest continuous level, 8 $\frac{1}{10}$ miles; total fall, from the point where the train was started to where it stopped, 210 feet.

The above train is unprecedented in length and weight, in Europe or America.

G. A. NICHOLLS,

Superintendent of transportation on the Philadelphia, Reading, and Pottsville railroad.

U. S. Gazette, Feb. 14th.

* See the number of this Journal for May, 1841, page 319.

Cadwallader Evans' Safety Valve.

Letter from Professor Joseph Henry.

Princeton, N. J., Feb. 25th, 1842.

C. Evans, Esq:

Dear Sir:—I have deferred answering your letter relative to your Safety Apparatus until I could find time to make some experiments with the model you sent me, but I have been unable to give the subject any attention until within a few days past.

I have for the last few years been in the habit of mentioning to my class the advantages of using the fusible metal inclosed in a tube surrounded by the steam, for the purpose of setting off an "alarm" in case of the undue heating of the boiler, as proposed by my friend, Professor Bache; but I was not aware of the fact, until I was informed of it by Professor Bache himself, that you had independently applied the same principle to set in operation a self-acting apparatus for relieving the safety valve in case of danger.

I have made a number of experiments with your apparatus, the results of which are perfectly satisfactory. To determine if the discharge of the steam always takes place at the same pressure, the composition of the fusible metal remaining the same, I attached to the boiler a manometer gauge, and found that in each case the discharge took place at about a pressure of thirty-three pounds per square inch. The indications of the gauge did not vary from this more than a pound on either side in any of the experiments, although the quantity of water in the boilers was not precisely the same in all cases. I also have made some experiments on surcharged steam; for this purpose the water was suffered to get low in the boiler, and then the fire was removed from the bottom to the sides, so as to heat the metal above the water line, and surcharge the steam. Under these circumstances the fusible metal gave way at a pressure of about sixteen pounds.

These results appear so satisfactory, that I do not hesitate to state that I consider the plan of using the fusible metal, inclosed in a tube, exposed to the steam, and your arrangement for relieving the safety valve at the approach of danger, as the best contrivance which has been proposed to the public as a means of preventing the disastrous explosions from steam. With my best wishes for your success in introducing your invention into general use,

I remain respectfully yours, &c.,

Joseph Henry.

Observations on the effect of wind on the Suspension Bridge over the Menai Strait, more especially with reference to the injuries which its roadways sustained during the storm of January 1839.

By W. A. Provis.

From the Proceedings of the Institution of Civil Engineers.

In the month of December, 1825, when the original construction of the bridge was nearly completed, several severe gales occurred, and

considerable motion was observed, both in the main chains and in the platform of the carriage ways. It appeared that the chains were not acted upon simultaneously, nor with equal intensity; it was believed, therefore, that if they were attached to each other, and retained in parallel plains, the total amount of movement would be diminished. On the 30th of January, and on tne 6th of February, 1826, some heavy gales again caused considerable motion of the chains and roadway, breaking several of the vertical suspending rods, and of the iron bearers of the platform. These bearers were constructed of wrought iron bars, overlapping each other, and bolted together, with the ends of the suspending rods between them, for the purpose of giving stiffness to the structure. The flooring planks were bolted to the bearers, and notched to fit closely round the suspending rods, which were thereby held almost immovably in the platform. It was observed, that the character of the motion of the platform was not that of simple undulation, as had been anticipated, but the movement of the undulatory wave was oblique, both with respect to the lines of the bearers, and to the general direction of the bridge. It appeared that when the summit of the wave was at a given point on the windward side, it was not collateral with it on the leeward side, but, in relation to the flow of the wave, considerably behind it, and forming a diagonal line of wave across the platform. The tendency of this undulation was, therefore, to bend the bearers into a form produced by the oblique intersection of a vertical plane with the surface of the moving wave. The bearers were not calculated to resist a strain of this nature; they therefore were fractured, generally through the eyes on each side of the centre foot path, at the point of junction with the suspending rods, which being bent backwards and forwards where they were held fast at the surface of the roadway, were in many instances wrenched asunder also. The means adopted for repairing these injuries, and for preventing the recurrence of them, were, placing a stirrup, with a broad sole, beneath each of the fractured bearers, attaching it by an eye to the suspending rod, cutting away the planking for an inch around the rods, and at the same time bolting, transversely, to the underside of the roadway, an oak plank, fifteen feet long, between each two bearers, for the purpose of giving to the platform a greater degree of stiffness, combined with elasticity, than it previously possessed. The four lines of main chains were also connected by wrought iron bolts passing through the joint plates, placed horizontally between the chains. The effects of these alterations and transversely hollow, cast iron, distance pieces were so beneficial, that little or no injury occurred for nearly ten years. On the 23d of January, 1836, a more than usually severe gale caused violent undulation of the platform, and broke several rods. There can be little doubt that ten years' constant friction, combined with the shrinking of the timber, had relaxed the stiffness of the platform, and permitted an increased degree of undulation. The gate-keeper described the extreme amount of the rise and fall of the roadway in a heavy gale to be not less than sixteen feet; the greatest amount of motion being about half way between the pyramids and the centre of the bridge. In conse-

quence of the injuries sustained during this gale, the author and Mr. Rhodes were instructed to give in a report upon the state of the bridge, and on any repairs or additions which might appear desirable. The result of the examination was satisfactory; the whole of the masonry, the main chains, their attachments to the rock, the rollers and iron work upon the pyramids, and all the principal parts of the bridge, was as perfect as when first constructed; it was, however, recommended, "that a greater degree of rigidity should be given to the roadways, so that they should not bend so easily under vertical pressure." The bridge remained in the same state until the hurricane of the 6th and 7th of January, 1839; during the night of the 6th, all approach to the bridge was impracticable; the bridge-keeper, however, ascertained that the roadways were partially destroyed; and he in consequence traversed the strait in a boat in time to prevent the down mail from London driving on to the bridge. When the day broke, it was found that the centre foot path alone remained entire, while both the carriage ways were fractured in several places. The suspending rods appeared to have suffered the greatest amount of injury; out of the total number of 444, rather more than one-third were torn asunder; one piece, 175 feet long, of the north east carriage way, was hanging down and flapping in the wind; much of the parapet railing was blown away; the ties and distance pieces between the main chains were destroyed; the chains had resisted well, in spite of the violent oscillation they had been subjected to, to such an extent as to beat them together and strike the heads off bolts of three inches diameter. Means were immediately adopted for restoring the roadways; and so rapidly was this effected, that in five days carriages and horses passed over, while foot passengers were not at any time prevented from crossing. The opinion of Colonel Pasley, "that all the injuries which have occurred to the roadways of Suspension Bridges must have been caused by the violent action of the wind from below," is examined, and reasons given for the author's dissent from that opinion. The action of the wind upon the Conway and Hammersmith Bridges, is next examined; and from the amount of oscillation observed in all suspension bridges, the conclusion is arrived at, that winds act strongly and prejudicially on the fronts as well as on the horizontal surfaces of the platforms of suspension bridges, and that the effect of winds is modified and varied by the nature of the country, and the local circumstances connected with each individual bridge. Although differing in opinion from Colonel Pasley as to the general cause of injury to suspension bridges, the author agrees with him in the propriety of giving increased longitudinal rigidity to their platforms, to prevent or to restrict undulation. He advised its adoption in 1836, and applied his plan of stiffening by beams in 1839. He preferred beams to trussed framing, on account of the facility with which the former could be increased in number, to obtain any requisite degree of stiffness, and because he feared that trussed frames could not always be kept firmly in their true vertical positions.

Mr. Cowper was of opinion, that the real cause of injury to suspension bridges was the vibration of the chains and roadway. The

whole of the suspended part, when acted upon by the wind, became in some measure a pendulum; and if the gusts of wind were to recur at measured intervals, according either with the vibration of the pendulum, or with any multiples of it, such an amount of oscillation would ensue as must destroy the structure.—Mr. Brunel agreed with Mr. Cowper in his opinion of the cause of injury to bridges, and with the propriety of applying brace-chains, for preventing the vibration. He then alluded to the introduction of lateral braces in the bridge designed by Mr. Brunel, Sen., for the Isle of Bourbon. He had been at the Menai Bridge during a severe storm, and had particularly noticed the vibration of the chains, with the accompanying undulation of the platform. The force of the wind was not apparently from beneath; it appeared to act altogether laterally. The chains were too high above the roadway; their vibration commenced before the platform moved; the unequal lengths of the suspension rods then caused the undulating motion. His attention had latterly been much given to the subject, on account of the Clifton Suspension Bridge, now erecting under his direction. The span would be seven hundred feet, and the height above the water about two hundred feet. He intended to apply the system of brace chains at a small angle to check vibration. To two fixed points in the face of one pyramid would be attached two chains, each describing a curve horizontally beneath the platform, touching respectively the opposite sides of the centre of the bridge, and then extending to similar points on the other pyramid; there they were attached to two levers, the ends of which were connected with a counterbalance of about four tons weight applied to each; these weights would hold the chains sufficiently extended to enable them to resist the lateral action of the strongest winds, without their being so rigid as to endanger any part of the structure. By this contrivance, the platform would be kept firm, which was the chief point to be attained. In all suspension bridges the roadways had been made too flexible, and the slightest force was sufficient to cause vibration and undulation. The platform of the Clifton Bridge would have beneath it a complete system of trough-shaped triangular bracing, which would render it quite stiff. He was an advocate for bringing the main chains down to the platform, as at the Hammersmith bridge, and for attaching the bearers to the chains at two points only; when they were suspended by four rods, it not unfrequently happened, that the whole weight of a passing load was thrown upon the centre suspension rods, and the extremities of the bearers were lifted up and relieved from all pressure. The extent of the expansion and contraction of the chains was a point of importance. In the Menai Bridge, the main chains on a summer day would be as much as sixteen inches longer than in a winter's night. At the Clifton Bridge the difference under similar circumstances would be about twenty inches. The whole expansion of the back chain beyond the pyramids must be thrown into the suspended part. He would prefer having only one chain on each side of the bridge, and that chain much stronger than is usually adopted, but in deference to public opinion he had put two; he believed that they rarely expanded equally, and hence an unequal distribution of the weight of

the roadways upon the suspension rods occurred. A rigid platform would in some degree prevent this, but he had endeavoured to lessen the effects of unequal expansion by arranging a stirrup at the top of each suspending rod, so as to hold equally at all times upon both the chains, and thus cause each to sustain its proportion of the load.

Athenæum, May, 1841.

Description of a Coffre Dam used in Excavating Rock from the Navigable Channel of the River Ribble. By D. Stevenson.

The navigation of the Ribble being much impeded by natural bars or weirs of sandstone rock, compact gravel, or loose sand, several ineffectual attempts were made to remove these hindrances, and eventually Messrs. Stevenson and Sons (of Edinburgh) were consulted, and under their directions the present works were commenced. About half a mile below Preston, a bed of sandstone rock, upwards of 300 yards in length, stretches quite across the river; the higher parts are frequently left dry during the summer months. This natural weir exerts such an influence upon the flow of the tides, that neap tides which at twelve miles distance rise 14 feet, are not at all perceived at the quay at Preston. It was proposed to cut a channel through this bar, affording an average navigable depth of 20 feet at high water of spring tides. In some places, therefore, the excavation would be 13 feet six inches deep. After consideration it was determined to make use of a series of coffre dams, as the most effectual and economical mode of proceeding. Their construction may be thus briefly described:—A double row of wrought-iron bars, 2¼ inches in diameter, with *jumper* points worked upon them, were inserted vertically into the rock at regular intervals of 3 feet apart laterally, the second row being placed 3 feet behind the front row. When a sufficient number of bars were fixed, a tier of planking, 3 inches thick, with clasps to enable the planks to be fixed to the rods, was placed withinside. The lower edges of the planks were cut out roughly to the inequalities of the rock; they were then lowered, and by means of an iron rod, with a crooked end, those parts which did not touch the bottom were ascertained, and a change in the form made, until the plank rested its whole length on the rock: the lower edge was then beveled off, and being finally lowered to its place, the plank was beaten down by the force of a heavy mallet, upon an upright piece of wood resting upon the upper edge of the planks; the lower beveled edge yielding to the blows, sunk into the irregularities of the rock, and thus ultimately, in connexion with the puddle behind it, formed a perfectly water-tight joint. The lower planks being fixed, the upper ones were placed upon them; transverse tie bars were inserted at intervals; and the clay puddle was formed in the usual manner. In order that the navigation of the river should not be impeded, the diagonal stays were all placed inside the dams. These stays had joints at the upper ends, and being slipped over the tops of the iron rods, and kept in their places by cotters, their lower ends could be moved either horizontally or vertically, as the irregu-

larity of the rock required:—as the excavation proceeded, longer stays were easily substituted, by merely removing the cotter, sliding up the short stay, and replacing it by another suited to the increased depth. The sides of the dam were kept together by bars of iron connected to two horizontal wale pieces, 10 inches by 6 inches, placed on the outside of the vertical iron rods. When the dam was thus constructed, the water was pumped out by a steam engine of ten-horses power. The whole of the excavation, which was 300 yards in length, and 100 feet in width, was to be completed with three lengths of coffre dams, so contrived as to include within the second stretch the lower side of the first dam, in order to excavate the rock in which that row of piles was fixed. The first and second lengths have been executed; the third is now in progress, and the excavation is proceeding very rapidly. The sandstone rock does not require gunpowder. The total quantity to be excavated is estimated at 31,000 cubic yards. Some doubt existed in the mind of the engineer as to the security of the fastening of the iron rod piles by merely jumping them from 15 to 18 inches into the rock; they have, however, proved to be perfectly firm during heavy floods, when the whole dam has been submerged, and the velocity of the current which was rushing over it was not less than five miles per hour.

Ibid, July, 1841.

Canal Navigation.

Hitherto, the suspension of trade on all canals, when covered with ice of a very trifling thickness, was considered unavoidable; but it has now been satisfactorily established, by the plan adopted on the Forth and Clyde canal during the late storm, that the obstruction, so far from being insuperable, can be completely remedied. The canal Company, and the traders on the canal, are indebted for this improvement to the ingenuity and persevering exertions of Mr. Robert Wilson, one of the overseers, by whom the plan was proposed and carried into execution. The object was effected by means of strongly constructed ice-breakers. By the plan adopted during the late frost, the extraordinary sight of fleets of twenty vessels attached to ice-breakers, and drawn by sixty horses, was daily to be seen passing along the Forth and Clyde canal, through ice from six to ten inches in thickness, at the rate of two miles an hour; and the extent of the benefit conferred on the trade is illustrated by the fact, that, in many instances, vessels which were towed by the ice-breaker from Port Dundas to Grangemouth, made their voyages to London, Hull, and Newcastle, returned with a new cargo to Grangemouth, and were taken back, along the canal by the ice-breakers to Port Dundas, during the continuance of a single frost. The importance of this subject to all owners of, and traders on, canals is so great as to call for the utmost publicity, in order that the improvement may be generally adopted throughout the country.

Railway Magazine, April, 1841.